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JOURNAL

BOMBAY NATURAL HISTORY SOCIETY.

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VOL. XXIX.

PARTS 1 & 2.

SMITHSONIAN INSTITUTION
SEP 7 1927
NATIONAL MUSEUM

BOMBAY:
PRINTED AT THE TIMES PRESS.
1924.

For convenience in binding it has been found advisable to issue the Index in two parts. The present issue includes the Index to Parts 1 and 2, Vol. XXIX, pp. 1-576. The Index to Parts 3 and 4 will be issued separately.

Instructions to Binder.

The contents of these two parts should be arranged in the following order when they are being bound :—

Title page.	To follow the frontispiece in this order.
Contents of Parts 1 and 2, Vol. XXIX.	
List of Contributors.	
List of Plates.	
Index to Illustrations.	
Errata	
Index to Species	To go at the end of the two numbers.
Map of South Waziristan	This map was omitted from the paper on "Notes on a Collection of Reptilia from Waziristan and the adjoining portion of the N. W. Frontier Province," by Capt. C. M. Ingoldby and Miss Procter, and should be included on page 117 of Vol. XXIX.

THE

JOURNAL

OF THE

BOMBAY NATURAL HISTORY SOCIETY.

EDITED BY

R. A. SPENCE, F.Z.S., M.L.A., and S. H. PRATER, C.M.Z.S.

VOL. XXIX.

277488

Parts 1 and 2.

Containing 2 coloured Plates, 63 Lithographed Plates, 3 Maps, 5 Diagrams and 22 Text-figures.

Dates of Publication.

Part I. (Pages 1 to 308)... ... 20th April 1923.
,, II. (,, 309 to 576)... ... 25th August 1923.

LONDON AGENTS:
DULAU & Co., Ltd, 34-36, Margaret Street, Cavendish Square, W.

PRINTED AT THE TIMES PRESS, BOMBAY.

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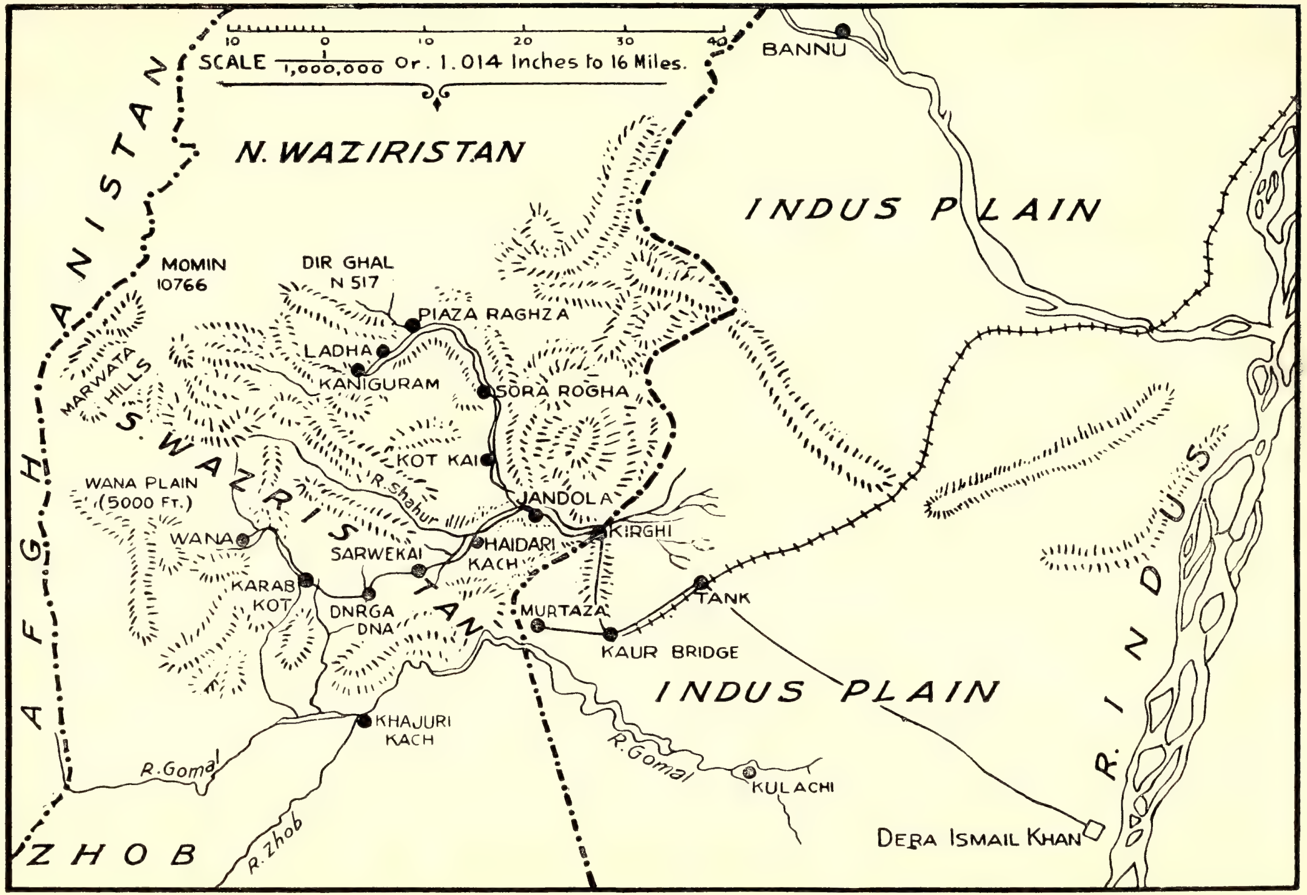
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MARWATA HILLS
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WANA
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SARWEKAI
KARAB KOT
DNRGA DNA
MURTAZA
TANK
KAUR BRIDGE
INDUS PLAIN
R. INDUS
KHAJURI KACH
R. Gomal
R. Gomal
KULACHI
DERA ISMAIL KHAN
ZHOB
R. Zhob

MAP OF SOUTH WAZIRISTAN.

THE

JOURNAL

OF THE

Bombay Natural History Society.

EDITED BY

R. A. SPENCE, M.L.A. F.Z.S., B. C. ELLISON, C.M.Z.S.,
and S. H. PRATER, C.M.Z.S.

VOL. XXIX, No. 1.

SMITHSONIAN INSTITUTION
SEP 7 1927
NATIONAL MUSEUM

Date of Publication, 20th April 1923.

Price to Non-Members ... . *Rs. 15-0-0*
or £ 1-0-0

LONDON AGENTS:
DULAU & Co., Ltd.,
34-36, Margaret Street, Cavendish Square, W.

PRINTED AT THE TIMES PRESS, BOMBAY.

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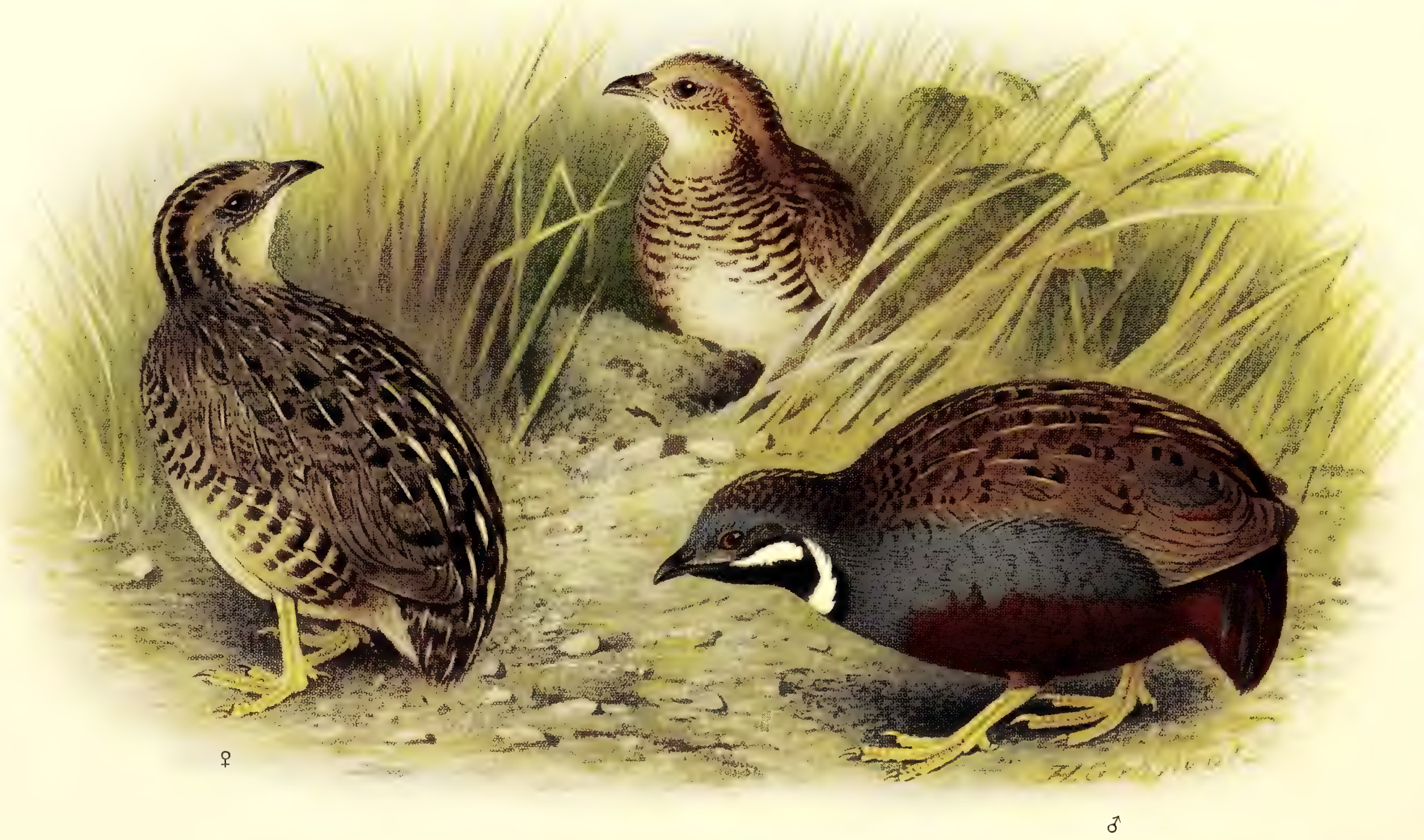

THE BLUE-BREASTED QUAIL
Excalfactoria c. chinensis.
($\frac{4}{5}$ natural size)

JOURNAL

OF THE

Bombay Natural History Society.

APRIL, 1923. VOL. XXIX. No. 1.

THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

BY

E. C. STUART BAKER, F.L.S., F.Z.S., M.B.O.U., C.F.A.O.U.

PART XXXIV.

(*With 1 plate.*)

(*Continued from page* 829 *of Volume XXVIII.*)

EXCALFACTORIA CHINENSIS CHINENSIS.

The Indian Blue-breasted Quail.

The Chinese Quail, Edwards, Gleanings Nat. His. v, p. 77, pl. 247, (1758), (Nanquin, China), Lath., Gen. Syn., ii, p. 783, (1783), (China and Philippines).

Tetrao chinensis Linn., S. N., i, p. 277, (1766), (China).

Perdix chinensis Lath., Ind. Orn., ii, p. 652, (1790).

Coturnix sinensis Bonnat., Tabl. Enclyc. Meth., i, p. 223, (1791).

Coturnix excalfactoria Temm., Pig. et. Gall. iii, pp. 516, 748, (1815).

Coturnix flavipes Blyth, J. A. S. B., xi, p. 808, (1842).

Coturnix chinensis Gray, List of Birds, p. 39, pl. iii., (1844); Layard, A. M. N. H., (2), xi, 4, p. 107, (1854), (Ceylon); Legge, B. of C., iii, p. 755, (1880); Parker, Ibis, 1886, p. 187, (Ceylon).

Coturnix philippensis Hodg., in Gray's Zool. Misc., p. 85, (1844).

Excalfactoria chinensis Bonap., Comp. Rend., xlii, p. 81, (1856); Jerd., B. of I., iii, p. 591, (1863); Swinh., Ibis, 1863, p. 398; id., P. Z. S., 1863, p. 308, (Formosa); Gould, B. of A., vii, pl. vi, (1867); Beavan, Ibis, 1868, p. 386, (Lower Bengal); Swinh., Ibis, 1870, p. 360, (Hainan); Holdsw., P. Z. S., 1872, p. 470, (Ceylon); Hume, Nests and Eggs, p. 553, (1873); Ball, S. F., ii, 428, (1874), (Chota Nagpur); Legge, Ibis, 1874, p. 26, (S. Ceylon); Hume, S. F., iii, p. 323, (1875), (Pakchan); Oates, ibid, p. 343, (Pegu Plains); Blyth and Wald., Cat. Mam. Birds, Burma, p. 151, (1875), (Arakan); Ball, S. F. vii, p. 226, (1878) (Raipur); Hume, ibid, viii, p. 69, (1879), (Malacca); Oates, ibid, p. 167, (Pegu); Hume and Marsh., Game B., ii, p. 162, (1879); Bidie, S.F., ix, p. 209,(1818), (Madras); Hume and Inglis, ibid, p. 258,(Cachar); Butler, ibid, p. 423, (Bombay); Reid, ibid, x, p. 63, (1881), (Lucknow); Wendon, ibid, p. 165, (Bombay); Oates, ibid, p. 263, (1882), (Pegu); Davison, ibid, p. 412, (1883), (Wynaad, Rampore, Mysore); Kelham, Ibis,1882, p. 3, (Malay States); Oates, B. of B., ii, p. 334, (1883); Muller, J. F. O., 1885, p. 160, (Salanga Is.); Hume, S. F., xi, p. 310, (1888), (Assam, etc.); Oates, Hume's Nest and Eggs, iii, p. 448, (1890); Ogilvie-Grant, Cat. B. M., xxii, p. 250, (1893); id, Game-B., i, p. 193, (1895); La Touche, Ibis, 1895, pp. 323, 338, (S. Formosa); Rickett and La Touche, Ibis, 1896, p. 493, (Fohkien); Blanford, Avifauna B. I. iv, p. 112, (1898); Oates, Game-B., i, p. 95, (1898); Seth-Smith, Av. Mag., iv, p. 200, (1898); Butler, ibid, p. 211; La Touche, Ibis, 1893, p. 283, (N. Formosa); Meade-Waldo, Av. Mag., v., p. 1, 1899; Stuart Baker, Jour. B. N. H. S., xii, p. 486, (1899), (N. Cachar); Inglis, ibid, xii, p. 677; Butler, ibid, p. 691, (Car Nicobars); Oates, Cat. Eggs, B. M., i, p. 47, (1901); Inglis, Jour. B. N. H. S., xiv, p. 562, (1902), (Behar); Seth-Smith, Bull, B. O. C., xiii, p. 72, (1902); Jesse, Ibis, 190, p. 152, (Lucknow); Bourdillon, Jour. B. N. H. S., xvi, p. 4, (1904), Travancore); Henry, Rev. Zool. Fr. d'Orn., i, p. 43, (1904); Kershaw, Ibis, 1904, p. 244, (China); Dewar, Jour. B. N. H. S., xvi, p. 495, (1905), (Madras); Macdonald, ibid, xvii, p. 496, (1906), (Myingyan); Ogilvie-Grant and La Touche, Ibis, 1907, p. 276, (Formosa); H. R. Baker, Jour. B. N. H. S., xvii, p. 760, (1907), (Singapore); Stuart Baker, ibid, p. 971, (Khasia Hills); Harington, ibid, xx, p. 377, (1910), (Bhamo); Hopwood, ibid, xxi, p. 1215, (1912), (Arakan); Hartert, Nov. Zool., xvii, p. 191, (1910), (Hainan); Stevens, Jour. B.N.H.S., xxiii, p. 723, (1915), (Upper Assam); Inglis, etc., ibid, xxvii, p. 153, (1920), (Bengal).

Exalfactoria minima Gould, P. Z. S., 1859, p. 128, (Celebes); Gould B. of A., vii, p. 7., (1867); Walden, Trans. L. S., viii, p. 87, (1872); id, ibid., x., p. 224, (1875).

Coturnix cainiana Swinh., Ibis, 1875, pp. 351, 542, (Swalow); id., ibid, 1870, p. 360.

Coturnix (Excalfactoria) chinensis Gray, List of Gall. B. M., p. 63, (1867).

Coturnix (Excalfactoria) minima Gray, ibid, p. 63.

Excalfactoria sinensis Hume and Dav., S. F. vi, p. 447, (1878), (Packchan); Bingham, ibid, ix, p. 196, (1880), (Kaukaryit); Rippon, Ibis, 1901, p. 556, (S. Shan State).

Excalfactoria chinensis chinensis Rob. and Kloss, Jour. Str. As. Soc. No. 80, p. 75, (1919), (N. E. Sumatra; Gyldenstope, Ibis, 1920, p. 786, (Siam).

Vernacular names.—Khair-butai, Kaneli, (Nepal); *Gobal butai,* (Oudh); *Ngôn,* (Burmese); *Pandura-watuwa, Wenella-watuwa,* (Cingalese); *Daobui majangbi,* (Cachari); *Shorbol,* (Manipuri).

Description, Adult Male.—Lores, forehead, a broad supercilium and sides of head and neck slaty grey; centre of crown and nape rufous brown, with broad concentric black bars; back, rump and upper tail-coverts rufous brown, with grey edges and broad black bars; the feathers of the centre of the crown and back have white shaft-streaks, broadest in the young, obsolete or absent in very old birds; tail feathers slaty-blue, edged with chestnut in young birds, almost wholly of this colour in very old individuals; a line under the lores to the eye white and under this, another from the angle of the mouth to the posterior ear-coverts black; below this again white; wings fulvous brown, much suffused with slaty-blue and more or less marked with bright rich chestnut on the inner secondaries and greater coverts; below chin and throat black, the black produced in a line upwards, round the white to join the black line above; foreneck white, edged with black; upper breast and flanks slaty-blue, this colour often running up and encroaching upon the sides of the neck and back; centre of breast, abdomen and under tail-coverts deep chestnut.

The amount of chestnut on the under plumage varies greatly both individually and with age; in a few old birds it runs right up to the black edge of the foreneck.

Colours of soft parts.—Iris bright vermilion-red to deep crimson, rarely a bright vinous pink; bill black, the edge, gape and gonys slaty, the extent of this slate colour varying considerably; legs and feet bright yellow, the soles paler and claws brownish.

Measurements.—Length about 140 to 155 mm.; wing 65 mm. (Celebes) to 78 (Assam); average of 70 birds, 70 mm.; tail about 25 mm.; tarsus 20 to 22 mm.; culmen 10 to 11 mm. Weight 1½ to 2 oz.

Birds from the more Northern parts, such as Assam, Northern Burma and China average a trifle larger than those from the extreme South, but the difference is very slight and the extremes are practically the same. Only three specimens, one from Assam, and two from Burma exceed 72 mm.

Adult female.—Above, like the male, but without any slaty-blue markings; the white or buff streaks are more numerous and more pronounced and generally there is less black, though this varies greatly in amount individually; the slaty-blue on the head is replaced by rufous; the chin and throat are fulvous-white and the rest of the lower plumage pale-buff, the fore-neck, breast and flanks barred with black; the tail is brown with buff and black markings.

Colours of soft parts.—Iris brown, occasionally reddish in old birds; bill as in the male but with the slaty colour more extensive; legs and feet bright yellow.

Measurements.—Much the same as the male; wing 66 to 77 mm.; average 30 specimens, 71.1 mm. Weight 1½ to nearly 2¼ ozs.

Young Male is like the adult but without any blue or chestnut above and with very broad buff centres to the feathers of the rump and upper tail-coverts ; below, the chestnut is confined to the centre of the belly or is absent altogether ; the slaty-blue is duller in tint and becomes brownish on the sides of the head and neck where it is distinctly barred with black.

The young male in first plumage is like the female but paler and more washed out in colour above, and also more rufescent in general appearance. The Iris is brown, glaucus brown or washed-out blue in very young birds ; bill dull slate colour ; legs wax yellow.

Chick in down.—The whole body and head, above and below, brown with the following exceptions which are buff : coronal streak and a streak on either side of the crown ; tips of the wings, sides of the head, chin and throat. The brown of the under parts is rather paler than that above and is somewhat dusty in tint.

Distribution.—The Blue-breasted Quail is a bird of very wide distribution, being found from Ceylon to Assam, throughout Burma and the Malay Peninsula, Siam, Cochin China, Yunnan, and West China. The Formosan and Hainan birds are not separable but closely allied races are found through the islands as far as Australia. Within the limits contained in this work its distribution is rather broken but it occurs *in suitable localities* practically throughout Ceylon, India West of a line drawn from Bombay to Simla, the whole of Burma to the extreme East and South. From many places whence this bird had not previously been recorded, I have had eggs sent me for identification proving its existence. It is comparatively common as a breeding bird from the South of Travancore, in which district it was obtained by Stewart and Bourdillon, along the Malabar coast to Bombay. It occurs, though possibly much more rarely, in Madras and South East India and becomes more common in North Orissa, Eastern Bengal and Behar and is very common in Assam, Manipur, Arakan, Pegu, and West Burma generally.

Nidification.—This pretty little Quail breeds and is resident whereever found, indulging merely in such small migrations as may be locally necessary in search of food or from pressure of rain and drought. Its breeding season varies greatly, but roughly speaking in Ceylon and South India it appears to be February to March ; in Northern India and Assam, June to August : from Burma, I have records of nests in January and again May to July, and in the Malay Peninsula in January, February and March. Everywhere, however, the full breeding season extends over a much longer season than the months noted above, and in Assam I have records of odd nests and eggs seen or taken in almost every month of the year.

When breeding, they seem to keep almost entirely to grasslands, or failing these, to low, thin scrub or open bamboo jungle with a little undergrowth. They are equally common in the plains and up to the level of 5,000 feet, being found at least one thousand feet higher again than this. I have never seen any semblance of a nest made; the eggs are just deposited in a hollow scratched amongst the grass roots, or under some bush or bamboo clump, such leaves or scraps of grass as may lie in this hollow are merely those which have fallen or been blown there. I have seen freshly scratched nest-holes containing single eggs without a leaf or scrap of grass under them although these lay around in profusion and had indeed been scratched out of the hollow itself prior to the egg being laid. Of course, in time leaves and blades of dried grass fall or get blown back and so the bird has got the credit of placing them there.

The hen bird does all the sitting as far as I have been able to ascertain, but she is so clever at secretively creeping off the nest when disturbed that one seldom gets a sight of her, the utmost being a momentary glimpse of a little brown back disappearing in the grass. She seems never, however suddenly frightened, to leave her nest by flight, and it is probably for this reason that the eggs have so often been found in places where the bird remains unknown. The chicks when disturbed lie where they are, absolutely still, and they may be picked up limp and feigning death, though the bright little eyes watching you all the time give them away. Directly the mother calls, each little furry lump awakes to life, and in a second or two all have vanished.

The eggs number five to seven, very rarely eight, and rather more often four only. In shape they are broad ovals, generally well pointed at the smaller end, and sometimes inclining to peg-top shape. The colour varies from a pale olive-clay colour, or nearly olive-yellow, through olive-brown and olive-drab to an almost rich chocolate brown. Many eggs are immaculate, others are sparsely and minutely speckled with black or very dark brown, and a few have these markings more numerous, and perhaps a little larger, as big as a small pin's head. One very curious clutch in my collection is dull grey apparently stippled all over with dull white; a second clutch laid by the same bird in a nest two or three feet away from the first, has one egg grey, three of a dirty yellow stone-colour and the fifth of a normal pale olive.

The extremes of measurement are: maxima 27·7×18·5 and 25·7×20·3 mm.: minima 22·9×17·3 mm., whilst the average of 100 eggs is 24·5×19·0 mm.

Habits.—The Painted Quail is found either in pairs or in small coveys consisting of the two old birds and their last family, and owing to the long breeding season, such coveys may be met with almost all the year round. Hume seems to have considered this Quail to be migratory over most of India whilst Oates records of Pegu.

> "The Blue-breasted Quail is distributed during the season over the whole of the Plains of the Pegu Province. About the 1st of May immense numbers arrive and spread themselves all

> over the country. At first the sexes remain in separate bevies, but by June, the pairing commences. After the breeding season, the majority, if not the whole, of the birds disappear. Some few may remain during the dry weather, but I am not sure of this. They like luxuriant grass growing in swampy plains, and numbers are flushed on the bunds of the paddy fields when the sportsman is after snipe."

In Assam also Hume says they are only monsoon visitors, but this is certainly not the case, and they are to be found throughout the year if one knows where to look for them. There are, however, two essentials for the country they reside in, first, ample water, and secondly, cover of the sort they prefer, *i.e.*, thin grass or reeds, sungrass three or four feet high, or fairly thin scrub and bush jungle. If there is heavier forest or jungle close by, so much the better, but they only seek safety in this when in danger. We also found them in Cachar and Sylhet in the dense ekra and elephant grass edges to the endless swamps in these districts but they came out of the heavy reeds in the mornings and afternoons to feed in the thinner grass alongside them, retiring once more during the heat of the day into their cool shade. In the winter and spring, as these swamps dry up the birds move with them, deserting those which are entirely dry for those in which some water still remains, whilst throughout the year they may be found in the bush or grass cover on the sides of the streams and water courses. In the hills where there were but few swamps they were quite content with grasslands through which a stream or two found their way and, in North Cachar, I several times put them out of the dense secondary growth which grows up in deserted cultivation. They were also to be found in standing crops of hill-rice, millet, etc., and in sugarcane.

Whenever I have seen this bird I have always found it extremely shy and difficult to watch, the slightest sound or movement sending it scuttling into cover when one comes on it unawares. Hume, however, writes :

> " They come freely into the open when feeding, and in the early mornings may be seen gliding along by the sides of the roads and paths, picking about and scratching here and there ; taking little notice of passengers, and either running on before them if not pressed, or just hiding up in the nearest tuft of grass, to emerge again as soon as the traveller has got ten or fifteen yards beyond their hiding place."

In Assam and Bengal one might get a rare sight *once* of a bird under the above circumstance, but never of the same bird twice. Even when one is hunting for them it is almost impossible to put them up again after they have once been flushed ; they run, dodge and hide so cleverly that even a good dog has all his work cut out to make them rise.

They are quiet little birds, but sometimes when first startled into flight utter a note which Davison syllabifies as "tir-tir-tir", uttered very quickly and sharply. The call of the mother to her young is a very soft repetition of the same note, the call between adults being a rather sweet double whistle sounding like "ti-yu ti-yu".

As to being a game-bird for sport this little Quail cannot lay much pretention It flies extremely well, straight and fast for fifty yards or more, just skimming over the tops of the grass and then suddenly falling headlong into it. It would be a difficult shot but for the fact that once started it usually flies in an absolute bee line until it drops and there are no disconcerting twists and twirls to put one off. In some places they are common enough to furnish half a dozen couple or so to a morning's work, but they are so hard to flush, even with dogs, and so tiny when killed that I could never help feeling that in shooting them one was more or less "murdering canaries". Thus though "Painted Quail" on toast are by no means to be despised, they are hardly worth while pursuing for the food they furnish.

They do not seem to be pugilistic birds and there are no native traditions referring to this trait.

Their food consists principally of seeds and grain, but they also eat insects of all the smaller kinds, and feed their young at first entirely on these.

EXCALFACTORIA CHINENSIS TRINKUTENSIS.

The Nicobar Blue-breasted Quail.

Excalfactoria trinkutensis Richmond, Pro. U. S. Nat. Mus., xxv, p. 310, (1903), (Trinkut Island, Nicobars).

Excalfactoria chinensis A. L. Butler, Jour. B. N. H. S., xii, p. 691, (1899), (Car Nicobars).

Vernacular names.—Mul (Car Nicobarese).

Description.—"Nicobarese specimens of this Quail have the back much suffused with the blue-grey of the breast and have the pale shaft stripes on the back entirely or almost entirely wanting." (A. L. Butler). In addition they seem to be distinctly darker birds.

Colours of soft parts.—"Iris crimson; legs orange, claws black; bill bluish horny." (Butler).

Measurements.—Length about 140 mm.; wing 69·5 mm.; tail 14·0 mm.; tarsus 13·5 mm.; culmen 10 mm.

Female.—"Similar to *E. chinensis*, but general colouration darker and richer, ground colour of feathers of the back, scapulars and sides of the neck, greyish, instead of brown, entire underparts, except throat, barred." (Richmond).

Colours of soft parts.—"Feet yellow". (Richmond.) "Iris brownish red; legs orange; claws brown, bill dusky bluish." (Butler).

Measurements.—"Wing 65 mm.; tail 22 mm.; tarsus 24·5 mm.; culmen 10 mm." (Richmond).

Butler gives the wing of the females as 69·9 mm.

Distribution.—Car Nicobars, and Trinkut Island and Camorta.

Nidification.—Unknown.

Habits.—Butler who first drew attention to the differences between this race and that on the mainland found this bird fairly common on one or two small grassy plains on the Northern island of Car Nicobar, and Richmond says that it was reported as "common in the open grass lands of Trinkut and Kamorta". All that is known of its habits is recorded by Butler who writes :

> "As usual they were very hard to flush in the long grass, and I found the best way to secure specimens was shooting over a rope dragged by two boys."

(*To be continued.*)

HAND-LIST OF THE "BIRDS OF INDIA."

BY

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PART VIII.

(Continued from page 873 of Volume XXVIII.)

Order STEGANOPODES.

Family PELECANIDÆ.

2027. (1521) **Pelecanus onocrocotalus onocrocotalus.** *The White or Roseate Pelican.*

Pelecanus onocrocotalus *Linn., S. N., i, p.* 132 (1758), (*Africa*).
S. Europe, N. Africa and S. W. Asia. Winter N. W. India.

2028. (1520) **Pelecanus onocrocotalus roseus.** *The Eastern Roseate Pelican.*

Pelecanus roseus *Gmel., S. N., i, p.* 570 (1789), (*Manila*).
Eastern Asia, Malay Arch. Straggler Burma and India.

2029. (1522) **Pelecanus crispus.** *The Dalmatian Pelican.*

Pelecanus crispus *Brüch., Isis.,* 1832, *p.* (1109), (*Dalmatia*).
S. Europe, N. Africa, W. Asia. Winter to N. W. India.

2030. (1523) **Pelecanus philippensis** *The Spotted-billed Pelican.*

Pelecanus philippensis *Gmel., S. N., i, p.* 571 (1789), (*Philippines*)
India, Ceylon, Burma and the whole Oriental Region.

Family FREGATIDÆ.

2031. (1524) **Fregata andrewsi.** *The Xmas Is. Frigate Bird.*

Fregata andrewsi *Mathews, Austral Av. Record, ii, p.* 110 (1914), (*Xmas Is. Indian Ocean*).
Rare visitor to coasts of India.

2032. (1525) **Fregata minor aldabrensis.** *The Western Lesser Frigate Bird.*

Fregata minor aldabrensis *Mathews, loc. cit. p.* 119 (*Aldadra*)
Casual in Ceylon

2033. **Fregata ariel iredalei.** *Iredale's Frigate Bird.*

Fregata ariel iredalei *Mathews, loc. cit., p.* 121 (*Aldabra*).
Casual on Eastern Coasts.

Family PHALCROCORACIDÆ.

2034. (1526) **Phalacrocorax carbo sinensis.** *The Indian Large Cormorant.*

Pelicanus sinensis *Shaw and Nod., Nat. Misc., xiii, p.* 529 (1801), (*China*).
Japan, China to India.

2035. (1527) **Phalacrocorax fuscicollis.** *The Indian Shag.*

Phalacrocorax fuscicollis *Steph., Shaw's Gen. Zool., xiii, p.* 91 (1825), (*India*).
Ceylon to N. Central India, Assam, Manipur, Burma.

2036. (1528) **Phalacrocorax javanicus.** *The Little Cormorant.*

Carbo javanicus *Horsf., Trans. L. S., xiii, p.* 197 (1821), (*Java*).
India, Ceylon, Burma, Malay Pen., Sumatra and Borneo.

2037. (1529) **Anhinga melanogaster.** *The Indian Darter or Snake-bird.*

Anhinga melanogaster *Pennant, Ind. Zool., p.* 13 (1769), (*India*).
The Oriental Region. Practically the whole of India, Burma and Ceylon.

Family SULIDÆ.

2038. (1530) **Sula leucogaster plotus.** *The Brown Gannet.*

Pelecanus plotus *Forster, Descrip. Ani., p.* 278 (1844), (*New Caledonia*).
Shot occasionally on the shores of India, Ceylon and Burma.

2039. (1531) **Piscatrix sula rubripes.** *The Australian Red-legged Gannet.*

Sula rubripes *Gould, Syn. B. of Aus., pt. iv, App. p.* 7 (1838), (*Raine Is. Queensland*).
Casual Bay of Bengal.

2040. (1532) **Parasula dactylatra personata.** *The Australian Masked Booby.*

Sula personata *Gould., P. Z. S.*, 1846, *p.* 21 (*Raine Is*).
Occasional, coasts of India and Burma, B. of Bengal.

Family Phaethonidæ.

2041. (1533) **Phäethon indicus.** *The Short-tailed Tropic-bird.*

Phäethon indicus *Hume, S. F., iv, p.* 481 (1876), (*Mekran*).
Breeding Persian Gulf. Indian Coasts.

2042. (1534) **Phäethon lepturus lepturus.** *The White Tropic-bird.*

Phäethon lepturus *Daudin, Buff., Hist. Nat., xiv, p.* 319 (1802), (*Mauritius*).
Casual Indian coasts; once Cachar.

2043. (1535) **Phäethon rubricauda rubricauda.** *The Red-tailed Tropic-bird.*

Phäethon rubricauda *Bodd., Tabl. Pl. Enl., p.* 57 (1783), (*Mauritius*).
Casual Indian Coasts.

Order TUBINARES.

Family Procellariidæ.

2044. (1536) **Oceanites oceanicus oceanicus.** *Wilson's Stormy Petrel.*

Procellaria oceanica *Kuhl, Beitr. Anat., ii, p.* 136. *pl. x.* (1820), (*S. Atlantic Ocean*).
Casual on Mekran Coast, etc. Atlantic and Indian Oceans.

2045. (1537) **Fregetta tropica melanogastra.** *The Dusky-vented Petrel.*

Thalassidroma melanogaster *Gould, A. M. N. H., xiii, p.* 367 (1844), (*Is. St. Paul*).
Once Bay of Bengal.

2046. (1538) **Puffinus pacificus chlororhynchus.** *The Green-billed Shearwater.*

Puffinus chlororhynchus *Less., Traite d'Orn., p.* 613 (1831), (*Shark Is.*).
Casual Madras.

2047. (1539) **Puffinus persicus.** *The Persian Shearwater.*

Puffinus persicus *Hume, S. F., i, p.* 5 (1873), (*Persian Gulf*)
Arabian Sea. Coasts of N. W. India.

2048. (1540) **Daption capensis.** *The Cape Petrel.*

Procellaria capensis *Linn., S. N., i, p.* 213 (1766), (*The Cape of Good Hope*).
Southern Oceans. Once in Ceylon.

Order HERODIONES.

Sub-order PLATALEÆ.

Family IBIDIDÆ.

2049. (1541) **Threskiornis melanocephalus melanocephalus.** *The White Ibis.*

Tantalus melanocephalus *Lath., Ind. Orn., ii, p.* 709, (1790), (*India*).

From S. Japan, through S. China to Burma, India and Ceylon.

2050. (1542) **Inocotis papillosus papillosus.** *The Indian Black Ibis.*

Ibis papillosa *Temm., Pl. Col., pl.* 304 (1824), (*India*).

Plains of N. India, S. to Mysore and E. to Assam and Arrakan.

2051. (1543) **Inocotis papillosus davisoni.** *Davison's Black Ibis.*

Geronticus davisoni *Hume, S. F., iii, p.* 300 (1875), (*Tenasserim*).

Pegu, Tenasserim, Siam and Cochin China.

2052. (1544) **Plegadis falcinellus falcinellus.** *The Glossy Ibis.*

Tantalus falcinellus *Linn., S. N., x, p.* 241 (1766), (*Austria*).

S. Europe, N. Africa, E. and Central Asia to Persia, E. India, Burma and Ceylon.

Family PLATALEIDÆ.

2053. (1545) **Platalea leucorodia major.** *The Indian Spoonbill.*

Platalea major *Temm. and Schleg., Faun. Jap., p.* 119 (1849), (*Japan*).

Egypt, Central and South Asia to Japan. All India, Burma and Ceylon.

Sub-order CICONIÆ.

Family CICONIIDÆ.

2054. (1546) **Ciconia ciconia asiatica.** *The Turkestan White Stork.*

Ciconia alba asiatica *Svertz., Turk. Jevot., p.* 145 (1873), (*Russian Turkestan*).

Turkestan, Yarkand, Bochara. Winter India to ? Ceylon.

2055. (1546) **Ciconia ciconia boyciana.** *The Chinese White Stork.*

Ciconia boyciana *Swinh., P. Z. S.,* 1873, *p.* 513 (*Yokohama*).

Ussuri to Japan. Winter S. China. Straggler Burma, Manipur and Assam.

2056. (1547) **Ciconia nigra.** *The Black Stork.*

Ardea nigra *Linn., S. N., i. p.* 142 (1758), (*N. Europe*).

Temperate Europe and Asia. S. to N. India, E. to Assam.

2057. (1548) **Dissoura episcopa episcopa.** *The Indian White-necked Stork.*

Ardea episcopus *Bodd., Pl. Enl., p.* 54 (1783), (*India*).

India, Ceylon, Burma to Tenasserim, N. Siam, etc.

2058. (1548) **Dissoura episcopa neglecta.** *The Javan White-necked Stork.*

Dissoura neglecta *Finsch., Orn. Monatsb., p.* 94 (1904), (*Java*).

S. Siam, Tenasserim, Malay States to Philippines.

2059. (1549) **Xenorhynchus asiaticus asiaticus.** *The Black-necked Stork.*

Mycteria asiatica *Lath., Ind. Orn., ii, p.* 670 (1790), (*India.*)

India, Ceylon, Burma, Malay States, etc. Siam.

2060. (1550) **Leptoptilus dubius.** *The Adjutant.*

Ardea dubia *Gmel., S. N., i, p.* 624 (1789), (*India*).

India, rare in the S. ; Burma, Siam, Malay Pen., etc.

2061. (1551) **Leptoptilus javanicus.** *The Smaller Adjutant.*

Ciconia javanica *Horsf., Trans. L. S., xiii, p.* 188 (1821), (*Java*).

Ceylon, S. and E. India, Assam, Burma, Siam, Malay Pen. to Java and Borneo.

2062. (1552) **Pseudotantalus leucocephalus leucocephalus.** *The Painted Stork.*

Tantalus leucocephalus *Penn., Ind. Zool., p.* 11, *pl. x* (1769), (*Ceylon*).

Ceylon, India (not Punjab), Burma, Siam, Cochin and S. China.

2063. (1553) **Anastomus oscitans.** *The Open-bill.*

Ardea oscitans *Bodd., Tabl. pl. Enl., p.* 55 (1783), (*Pondicherry*).

Ceylon, India, Burma, Siam, Cochin China, etc.

Sub-order ARDEÆ.

Family ARDEIDÆ.

2064. (1554) **Ardea purpurea manillensis.** *The Eastern Purple Heron.*

Ardea purpurea *var.* manillensis *Meyen, Acta. Acad. Leop. Carol. Suppl.*, p. 102 (1831), (*Philippines*).
Ceylon, India, Burma, Siam, China, etc.

2065. (1555) **Ardea cinerea cinerea.** *The Common Grey Heron.*

Ardea cinerea *Linn., S. N., i, p.* 143 (1758), (*Sweden*).
Europe, Africa, W. and Central Asia to Ceylon, India and Burma.

2066. (1555) **Ardea cinerea jouyi.** *The Eastern Grey Heron.*

A. c. jouyi *Clark, Pro. U. S. Nat. Mus., xxxii, p.* 468 (1907), (*Corea*).
E. Asia. S. and S. W. Siam? Tenasserim.

2067. (1556) **Ardea sumatrana sumatrana.** *The Dusky Grey Heron.*

Ardea sumatrana *Raffl., Trans. L. S., xiii, p.* 325 (1822), (*Sumatra*).
S. Burma, Siam, Malay Pen., etc.

2068. (1557) **Ardea insignis.** *The Great White-bellied Heron.*

Ardea insignis *Hume, S. F., vi, p.* 470 (1878), (*Sikkim Terai*).
Sub-Himalayan Terai, Nepal to E. Assam. Bhamo.

2069. (1558) **Ardea goliath.** *The Giant Heron.*

Ardea goliath *Cretzschm., Rupp. Atl., p.* 39, *pl.* 36, (1826), (*Africa*).
Africa. Casual in various parts of India and Ceylon.

2070. (1559) **Egretta alba alba** *The Large Egret.*

Ardea alba *Linn., S. N., i, p.* 144 (1758), (*Europe*).
S. Europe, N. Africa, N. Asia to N. W. India.

2071. (1559) **Egretta alba modesta.** *The Eastern Large Egret.*

Ardea modesta *Gray, Zool. Misc., p.* 19 (1831), (*India*).
Tropical India and China to Japan.

2072. (1560) **Egretta intermedia intermedia.** *The Indian Smaller Egret.*

Ardea intermedia *Wagler, Isis,* 1829, *p.* 659 (*Java*).
Ceylon, India, China, etc.

2073. (1561) **Egretta garzetta garzetta.** *The Little Egret.*
Ardea garzetta *Linn., S. N., i., p.* 237 (1766) (*in Oriente*).
S. Europe, N. Africa, W. Asia, Central and S. Asia to Japan.

2074. (1562) **Bubulcus ibis coromandus.** *The Cattle Egret.*
Cancroma coromanda *Bodd., Tabl. Pl. Enl., p.* 54 (1783), (*Coromandel*).
Ceylon, India, Burma, Siam, etc. to S. Japan.

2075. (1564) **Demiegretta sacra sacra.** *The Eastern Reef-Heron.*
Ardea sacra *Gmel., S. N., i, p.* 640 (1788), (*Tahiti*)
Burma, Andamans and Nicobars, Malay Pen. and Arch. to China, Japan, etc.

2076. (1563) **Demiegretta sacra asha.** *The Indian Reef-Heron.*
Ardea asha *Sykes, P. Z. S.*, 1832, *p.* 157 (*Deccan*).
Coasts of India and Ceylon to Persian Gulf.

2077. (1565) **Ardeola grayii.** *The Indian Pond Heron.*
Ardea grayii *Sykes, P. Z. S.*, 1832, *ii, p.* 158 (*Deccan*).
Ceylon, India, S. Persia, Burma, Malay Pen., Siam.

2078. (1566) **Ardeola baccha.** *The Chinese Pond Heron.*
Buphus bacchus *Bonap., Consp. Av., ii, p.* 127 (1855), (*Malacca*).
Assam, Burma, Siam, Malay Pen., S. China to S. E. Siberia and Japan.

2079. (1567) **Butorides striatus javanicus.** *The Indian Little Green Heron.*
Ardea javanica *Horsf., Trans. L. S., xiii, p.* 190 (1821), (*Java*).
India, Ceylon, Burma, Malay Pen. to S. China, Celebes, etc.

2080. (1567) **Butorides striatus spodiogaster.** *The Andaman Little Green Heron.*
Butorides spodiogaster *Sharpe, Cat. B. M., iii., p.* 17 (1894), (*Andamans*).
Andamans and Nicobars.

2081. (1568) **Nycticorax nycticorax nycticorax.** *The Night-Heron.*
Ardea nycticorax *Linn., S. N., i, p.* 239 (1766), (*West Europe*).
S. and Central Europe, N. Africa, India, etc. East to Japan.

2082. (1569) **Gorsachius melanolophus.** *The Malay Bittern.*

Ardea melanolopha *Raffl., Trans. L. S., xiii, p.* 326 (1822), (*Sumatra*).

Ceylon and W. Coast of India to Kanara. Assam, Burma, Siam, Malay Pen., etc.

2083. (1570) **Ixobrychus minutus minutus.** *The Little Bittern.*

Ardea minuta *Linn., S. N., i, p.* 240 (1766), (*Helvetia*).

Europe, N. Africa, W. and C. Asia. Himalayas E. to Assam.

2084. (1571) **Ixobrychus sinensis.** *The Yellow Bittern.*

Ardea sinensis *Gmel., S. N., i, p.* 642 (1789), (*China*).

N. India, Burma, Ceylon, Siam, Malay Pen., etc., to Japan.

2085. (1572) **Ixobrychus cinnamomeus.** *The Chestnut Bittern.*

Ardea cinnamomea *Gmel., S. N., i, p.* 643 (1789), (*China*).

Ceylon, India, Burma, Siam, Malay Pen. to China, etc.

2086. (1573) **Dupetor flavicollis flavicollis.** *The Black Bittern.*

Ardea flavicollis *Lath., Ind. Orn., ii, p.* 701 (1790), (*S. China*).

Ceylon, India, Burma, Siam, Malay Pen. to Celebes, etc., China.

2087. (1574) **Botaurus stellaris stellaris.** *The Bittern.*

Ardea stellaris *Linn., S. N., i., p.* 144 (1758), (*Sweden*).

Europe, N. Africa, N. Asia to Japan. Winter to India, Burma, etc.

Order PHŒNICOPTERI.

Family PHŒNICOPTERIDÆ.

2088. (1575) **Phœnicopterus ruber antiquorum.** *The Common Flamingo.*

Phœnicopterus antiquorum *Temm., Man. d'Orn., p.* 587 (1820), (*Europe*).

S. Europe, N. Africa, Transcaspia to Persian Gulf ; India and Ceylon.

2089. (1576) **Phœnicopterus minor.** *The Lesser Flamingo.*

Phœnicopterus minor *Geoffr., Bull. Soc. Philom., i, p.* 98 (1798), (*E. Africa*).

E. Africa and Madagascar. India W. and N. W.

Order ANSERES.

Family Anatidæ.

Sub-family *Cygninæ.*

2090. (1578) **Cygnus cygnus.** *The Whooper.*

Anas cygnus *Linn., S. N., i., p.* 122 (1758), (*Sweden*).
A rare straggler into N. W. India. N. Europe and Asia to Japan.

***2091.** (1578) **Cygnus bewicki.** *Bewick's Swan.*

Cygnus bewicki *Yarrel, Trans. L. S., xvi., p.* 453 (1830), (*Yarmouth*).
Two occurrences in India. N. Europe and N. W. Asia to the Lena.

2092. **Cygnus minor.** *Alpheraky's Swan.*

Cygnus minor *Keyser. & Blas., Werbelthiere, pp. lxxii.,* 222 (1840), (*Selenga River*).
One occurrence in India. N. E. Asia from the Lena to Japan.

2093. (1577) **Cygnus olor.** *The Mute Swan.*

Anas olor *Gmel., S. N., i., p.* 501 (1789), (*Russia*).
A not very rare visitor to N. W. India, Central Europe, Central Asia and N. Africa.

Sub-family *Plectropterinæ.*

2094. (1584) **Sarcidiornis melanota.** *The Nukhta or Comb-Duck.*

Anser melanotos *Penn., Ind. Zool., p.* 12, *pl.* 12 (1769), (*Ceylon*).
Practically all India to Assam, Burma, Siam, Malay Pen.

2095. (1585) **Asacornis scutulata.** *The White-winged Wood-Duck.*

Anas scutulata *Muller, Verh. Land en Volk., p.* 159 (1842), (*Java*).
Assam, Burma to Tenasserim, Malay Pen., Java and Sumatra, Siam, etc.

2096. (1585) **Rhodonessa caryophyllacea.** *The Pink-headed Duck.*

Anas caryophyllacea *Lath., Ind. Orn., ii., p.* 866 (1790), (*India*).
Bengal and Assam, rare W. to Arrah and Oudh, S. to Madras and E. to Pegu.

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* Hartert considers *Cygnus bewicki* and *Cygnus minor* (*jankowskii*) to be races only of the same species. This still appears doubtful, and I retain them as species until we know more of their life history.

2097. (1591) **Nettopus coromandelianus.** *The Cotton Teal.*

Anas coromandeliana *Gmel., S. N., i., p.* 522 (1789), (*Coromandel Coast*).

Ceylon, India, Burma, China and S. to Philippines, Celebes, etc.

2098. **Aex galericulata.** *The Mandarin Duck.*

Anas galericulata *Lath., Ind. Orn., ii., p.* 871 (1790), (*China*).

India, twice in Assam ; Central and S. China to Japan and Amur.

Sub-family *Anserinæ.*

2099. (1579) **Anser anser.** *The Grey Lag Goose.*

Anas anser *Linn., S. N., i., p.* 123 (1758), (*Sweden*).

From N. W. India to Assam, Burma in winter.

2100. (1580) **Anser albifrons albifrons.** *The White-fronted Goose.*

Branta albifrons *Scop., Ann. i., His. Nat., p.* 69 (1769), (*N. Italy*).

Iceland to Siberia. A regular though uncommon visitor to India, Assam and Burma.

2101. (1581) **Anser erythropus.** *The Dwarf Goose.*

Anas erythropus *Linn., S. N., i., p.* 123 (1758), (*Sweden*).

N. Europe and Asia. Straggler to N. India in winter.

2102. (1582) **Anser neglectus.** *Sushkin's Bean Goose.*

Anser neglectus *Sushk., Bull. B. O. C., v., p.* 6 (1893), (*E. Russia*).

N. Europe and Asia. Once India in Assam.

2103. **Anser fabilis sibiricus.** *Middendorf's Bean Goose.*

Melanonyx arvensis sibiricus *Alpheraky, Geese, p.* 104 (1905), (*Taimyr*).

N E. Asia.

2104. **Anser brachyrhynchus.** *The Pink-footed Goose.*

Anser brachyrhynchus *Baillon, Mem. S. R. Abbe., p.* 74 (1883), (*Abbeville, Somme*).

Breeding Spitzbergen, etc. Winter to Persia, India, etc.

2105. (1583) **Anser indicus.** *The Bar-headed Goose.*

Anas indica *Lath., Ind. Orn., ii , p.* 839 (1790), (*India*).

Central Asia to W. China. Winter India, Burma, Shan States, etc.

2106. **Branta ruficollis.** *The Red-breasted Goose.*

Anser ruficollis *Pallas, Spicil. Zool., p.* 21 (1769), (*Ob River*).

Breeding W. Siberia; winter Europe and S. W. Asia, once India.

Sub-family *Anatinæ.*

2107. (1589) **Dendrocygna javanica.** *The Lesser or Common Whistling Teal.*

Anas javanica *Horsf., Trans. L. S., xiii., p.* 199 (1821), (*Java*).

Ceylon, India, Burma, Siam, China, Malay Pen. to Borneo and Java.

2108. (1590) **Dendrocygna fulva.** *The Greater Whistling Teal.*

Anas fulva *Gmel., S. N., i., p.* 530 (1789), (*Novo Hispania*).

Practically all India, Burma, Siam in suitable localities.

2109. (1587) **Tadorna tadorna.** *The Sheldrake.*

Anas tadorna *Linn., S. N., i., p.* 122 (1758), (*Sweden*).

N. and Central Europe and Asia. Rare N. India and Burma in winter.

2110. (1588) **Casarca ferruginea.** *The Ruddy Sheldrake or Brahminy Duck.*

Anas ferruginea *Pall., Vroeg's Cat. Adum., p.* 5 (1764), (*Tartarei*).

Central and South Europe and Asia. S. to India, Ceylon, Burma, China, etc.

2111. (1592) **Anas platyrhyncha platyrhyncha.** *The Mallard.*

Anas platyrhynchos *Linn., S. N., i., p.* 125 (1758), (*Sweden*).

Europe. N. and Central Asia. In winter N. and Central India, Burma, etc.

2112. (1593) **Anas pœcilorhyncha pœcilorhyncha.** *The Indian Spotbill or Grey Duck.*

Anas pœcilorhyncha *Forster, Penn. Ind. Zool., xiii., p.* 28 (1781), (*Ceylon*).

India, Ceylon, Assam, N. of the Brahmaputra, etc.

2113. **Anas pœcilorhyncha zonorhyncha.** *The Chinese Spot-Bill or Grey Duck.*

Anas zonorhyncha *Swinh., Ibis,* 1866, *p.* 394 (*Ningpo*)

China, E. Siberia, straggler in winter to N. Burma and Assam.

2114. **Anas pœcilorhyncha haringtoni.** *The Burmese Spot-Bill or Grey Duck.*

Polionetta haringtoni *Oates, J. B. N. H. S., xvii., p.* 558 (1907), (*Shan States*).
Burma to extreme E. Assam, Yunnan, Cochin China, Siam, etc.

2115. (1594) **Eunetta falcata.** *The Bronze-capped Teal.*

Anas falcata *Georgi, Bemerk. Reise. Russ. Reich., i., p.* 167 (1775), (*Asiatic Russia*).
Eastern Asia, straggler to Europe. Winter S. China, regular but rare in India and Burma.

2116. (1595) **Chaulelasmus streperus.** *The Gadwall.*

Anas strepera *Linn., S. N., i., p.* 125 (1758), (*Sweden*).
Northern Hemisphere. Winter India and Burma; once in Ceylon.

2117. (1599) **Mareca penelope.** *The Wigeon.*

Anas penelope *Linn.. S. N., i., p.* 126 (1758), (*Sweden*).
Europe and Asia. Winter to India and Burma, N. Africa, etc.

2118. (1596) **Nettion formosum.** *The Baikal or Clucking-Teal.*

Anas formosa *Georgi, Bemerk. Reise. Russ. Reich., p.* 168 (1775), (*Sweden*).
N. E. Asia; winter S. to China, etc. Very rare straggler to India.

2119. (1597) **Nettion crecca crecca.** *The Common Teal.*

Anas crecca *Linn., S. N., i., p.* 125 (1758), (*Sweden*).
Breeding Palearctic region. Winter India, Burma and Ceylon.

2120. (1598) **Nettion albigulare.** *The Andaman Teal.*

Mareca albigularis *Hume, S. F., i., p.* 303 (1873), (*Andamans*).
Andamans and Cocos Is.; once Bassein.

2121. (1600) **Dafila acuta.** *The Pintail.*

Anas acuta *Linn., S. N., i., p.* 126 (1758), (*Sweden*).
Breeding N. Hemisphere; winter N. Africa, S. Asia, whole Indian Empire.

2122. (1601) **Querquedula querquedula.** *The Garganey or Blue-wing Teal.*

Anas querquedula *Linn., S. N., i., p.* 126 (1758), (*Sweden*),
Eastern Palearctic Region; winter S. Europe, N. Africa, S. Asia.

2123. (1604) **Spatula clypeata.** *The Shoveller.*

Anas clypeata, *Linn., S.N., i., p.* 124 (1758), (*Sweden*).
Whole Northern Hemisphere ; winter whole Indian Empire, etc.

2124. (1603) **Marmaronetta angustirostris.** *The Marbled Duck.*

Anas angustirostris *Ménétries, Cat. Reis. Caucas., p.* 58 (1832), (*Lenkoran*).
Mediterranean countries, E. to India, Sind, common, to Calcutta, rare.

2125. (1604) **Netta rufina.** *The Red-crested Pochard.*

Anas rufina *Pallas, Reise. Russ. Reich., ii., p.* 713 (1773), (*Caspian Sea*).
Mediterranean countries and W. Central Asia ; N. Central and S. India and Burma.

2126. (1605) **Nyroca ferina ferina.** *The Pochard or Dun-Bird.*

Anas ferina *Linn., S. N., i., p.* 126 (1758), (*Sweden*).
Temperate N. Hemisphere ; winter India S. to Mysore, Burma, etc.

2127. (1606) **Nyroca rufa rufa.** *The White-eyed Pochard or White-Eye.*

Anas rufa *Linn, Faun. Svec. 2nd ed., p.* 47 (1761), (*Sweden*).
Breeding S. Europe and Central Asia, S. India to Mysore, Burma to Arakan.

2128. (1607) **Nyroca rufa bæri.** *Baer's Pochard, or the Eastern White-Eye.*

Anas bæri *Radde, Reise. Siberien, ii., p.* 376 (1863), (*Amur*).
Breeding E. Siberia. In winter, S. China, etc. Rare, Burma and N. E. India.

2129. (1608) **Nyroca marila marila.** *The Scaup.*

Anas marila *Linn., Faun. Svec. 2nd ed., p.* 39 (1761) (*Lapland*).
Breeding N. Europe and Asia. Winter South. Rare visitor N. India.

2130. (1609) **Nyroca fuligula.** *The Tufted Pochard.*

Anas fuligula *Linn., S. N., i., p.* 128 (1758), (*Sweden*).
Breeding Palearctic Region and N. Africa ; winter India and Burma, etc.

2131. (1610) **Glaucionetta clangula clangula.** *The Golden Eye.*

Anas clangula *Linn., S. N., i., p.* 126 (1758), (*Sweden*).
Breeding N. Europe and Asia, winter South, straggler in N. India.

2132. (1611) **Erismatura leucocephala.** *The White-headed or Stiff-tailed Duck.*

Anas leucocephala *Scop., Ann. i. Nat. His., p.* 65 (1769), (*N. Italy*).

Mediterranean countries, W. Central Asia. Common straggler, N. W. India.

2133. (1612) **Mergus albellus.** *The Smew.*

Mergus albellus *Linn., S. N., i., p.* 129 (1758), (*Smyrna*).

Breeding Palearctic Regions. Fairly common visitor, N. India in winter.

2134. (1613) **Merganser merganser orientalis.** *The Eastern Goosander.*

Mergus orientalis *Gould, P. Z. S.*, 1845, *p.* 1 (*Amoy*)

Baluchistan, Himalayas to E. Tibet, N. Indian sub-Himalayas in winter.

2135. (1614) **Merganser serrator.** *The Red-breasted Merganser.*

Mergus serrator *Linn., S. N., i., p.* 129 (1758) (*Sweden*).

Breeding, N. Hemisphere. Very rare winter straggler to India.

Order PYGOPODES.

Family PODODICIPEDÆ.

2136. (1615) **Podiceps cristatus cristatus.** *The Great Crested Grebe.*

Colymbus cristatus *Linn., S. N., i., p.* 135 (1758) (*Sweden*).

Temperate Europe, Asia and Africa; winter common N. India and Burma.

2137. (1617) **Podiceps ruficollis albipennis.** *The Indian Little Grebe.*

Tachybaptes albipennis *Sharpe, Bull. B.O.C., iv., p.* 4. (1894), (*Peninsula India*).

India, Ceylon, Burma.

2138. (1616) **Podiceps nigricollis nigricollis.** *The Black-necked Grebe.*

Podiceps nigricollis *Brehm, Handb. Vog. Deutchl., p.* 963 (1831), (*Holland*).

Temperate Europe, Asia and Africa. Winter N. India, common N. W.

An addenda and corrigenda to the Hand-list of Birds will be published subsequently.

GAME ANIMALS OF KASHMIR AND ADJACENT HILL PROVINCES.

BY

COL. A. E. WARD.

PART V.

(*With a plate.*)

(*Continued from page* 882 *of Volume XXVIII*).

BEASTS OF PREY.

THE CATS.

There are a large number of different cats in the countries with which these articles are concerned, nearly all of the various species attract the attention of sportsmen for the sake of their skins.

THE LEOPARD (*F. pardus*).

Leopard shooting is a useful occupation, so also is trapping. The number of deer, sheep and goats, both wild and tame, destroyed by leopards is very great, and where game congregates there the leopard will come. In 1920 in the Dachgam game reserve, forty-one deer killed by this destructive cat were found. How many more were killed that were never heard of, it is impossible to say.

Sitting over a kill in a game reserve is not often successful, the leopard seldom returns and even if it had any intention of doing so, the chances are that other animals will be met on the way and be taken instead of the previous kill.

In India a stag sambhar is more or less immune from the attacks of the pard, but in snow covered hills the biggest stags of the Kashmir deer are driven downwards by the leopards and easily killed. Of course a sambhar is much bigger than the stag of Kashmir, but still the latter weighs 30 stone (or over 400lbs.) and a leopard is only between 75 and 150 lbs. It is the advantage given by the snow which enables the leopard to hold the *barasing.* In the jungles the stags are not attacked, for if a powerful deer bolted through the jungle carrying the leopard it would get free and the attacker have a bad time against the trees.

There is very little to be gained by beating with coolies for leopards in thick jungles owing to their habit of crawling through the undergrowth and of taking the first opportunity of breaking back.

In the Terai many can be shot, if in the early morning a staunch pad elephant is used. By moving slowly about, listening for the "fright" call of the deer, which so often betrays the vicinity of a big cat, and wandering quietly up and pottering about, the leopard can often be seen or moved. If silently followed, a shot can generally be obtained, provided the undergrowth or grass is not too dense, but shikar in the Terai is not the subject now to be dealt with, so a return to these hills and their leopards must be made.

The most exciting method is tracking in the snow ; a kill having taken place during the night it is necessary to get on the tracks as soon as possible. If the carcase is in the open below a bare hill, the leopard will probably go up to the rocks above, where, if gorged, it will rest. Caution is necessary and the use of dogs is a desirable safeguard, for the shot may have to be taken from below. A wounded leopard will attack at great speed and may get home, but if the dogs are up to their work they will divert the attention of the leopard by barking and running in.

On one fatal occasion Colonel Turnbull, who had killed scores of leopards by tracking in the snow, had with him his dogs, but the attendants lost their heads, and did not slip the dogs until the damage was done and Turnbull was mauled beyond recovery.

If the kill is near jungle and the pard has not fed freely, it will most likely conceal itself close at hand ; in that case the dogs may turn it out, when it may go up a tree or afford a shot to the sportsmen who has posted himself in a likely place.

Once, a pony was killed not far from a patch of jungle which was perhaps three or four acres in extent with broad strips of snow between it and the main forest. After ringing round the place and ascertaining that the leopard had not passed through, the dogs were put in, whilst the two guns were posted on the side nearest the main jungle. A chorus of barking and a howl ensued, and the leopard showed for a second on the edge of the cover, but turned back. The dogs came out, then went in again and barked furiously, and the look out reported that the pard had come out but had run along the end of the cover and then re-entered. The snow was deep and the undergrowth dense and tangled, and the dogs becoming tired out appeared from various parts of the jungle, and lay down panting in the snow. Two dogs, a cross between an Airdale and a Brinjara had been a bit scratched, but beyond being rendered very cross did not seem perturbed. After a rest, the pack went in again but nothing happened ; probably the leopard had secreted itself under a dense bush or stone. Whilst the chase lasted it was great fun, but it was a failure which caused disappointment, for this leopard had for long past been an inveterate deer-slayer. To this day it has not been bagged and unfortunately is cleverer than ever, for a badly placed shot has damaged a fore-leg. The guard in charge of the beat states that ponies and full grown deer are now beyond the killing power of this leopard, and evidently the man believes that this is so, for his pony was grazing close to the jungle a few weeks ago.

The leopard is a vermin beast of the worst order, and as such should be trapped on every occasion, the depredations of a pair amounting to much more than a dozen rifles can effect. Trapping is a fascinating form of sport. The large gins are not generally successful ; the best of these have curved jaws which, when they close, grip the leg high up, the flat jaw only closes on the foot, and is shaken or bitten off, sometimes cutting off the toes.

By setting a large number of strong brass-bound, 5-inch jaw, Dorset traps round a kill several leopards have been caught as one or two feet are entrapped. In Wangat about two dozen of these gins were lightly pegged down round a dead pony just before dark. In the morning two foxes were found, several traps were sprung, and two were missing. A leopard's tracks were visible on the snow and signs of a drag behind the track. The trail was irregular, the leopard had stopped at intervals turned and scrambled about. Not far off was a thick growth of wild indigo, and from within came coughing growls. The gun-bearer shouted to loose the dogs, and this brought the leopard out in a shambling charge ; a shot hit somewhere, but the dogs got in before a second shot could be fired. A big bull dog (a present from the Poonch Raja) got a grip on the side of the leopard's head, whilst the two half bred Airedales went in and took worrying grips anywhere, whilst the other dogs barked around. The trouble was how to finish the beast, as the dogs could not or would not hear. After a short time the struggle almost ceased and a shot fired at a distance of a few yards ended the excitement. One trap, which had evidently been fixed on the middle of the leopard's tail, had fallen off, the second enclosed the fore-foot. " Poor beast " might almost be said, but it was a good riddance, though perhaps not a fair fight.

There remained the bull dog, which was covered with blood, and the two Airdales, both furiously angry and a bit cut about. They were difficult to doctor up but healed fairly quickly.

Other captures could be written about; a few weeks ago a young leopardess took the trap on its foot for quite half a mile and then lay down on a fuel pathway, and tried to charge the tracker. On a narrow bridge where a leopardess and a cub used to cross a large trap was set, with smaller ones here and there, the cub was caught and the mother left a few hairs in the big gin. Small traps are successful at times but very often they fail, as the leopard will frequently, after going a short distance, free itself from the trap, or break it whilst dragging it through rocks and jungle.

The best trap is that made in Nepal. The description was given in the "Tourists and Sportsman's Guide," and is as follows:—

Select a suitable place where the bleating of the kid, which is used as a bait, can be heard on all sides. Drive into the ground two parallel rows of stout hard wood stakes leaving not more than 2 feet between the rows. For a single entrance "door trap" about 6½ feet will suffice; for a double door trap 11 feet. The stakes should be 2 feet above the ground.

In the centre of a double door trap, or at one end if for a single entrance, stake off a 2-foot compartment for the kid which is to form the bait—leave this compartment open at the top but put strong cross pieces on the upright stakes elsewhere. Next come the doors which must be stout 1½″ board; the doors are set exactly like those of a box rat-trap, but, where the bait usually is placed on a hook, fasten two strong cross wires at right angles to one another; by clawing at these wires the leopard springs the trap and the door falls.

The kid is put into the compartment, the top is then closed with a large flat stone, or board, on which stones are piled. The less finish there is the better; clean up all chips of wood, leave the bark on the stakes, and weight the doors with heavy stones so that they may fall quickly. Finally when all is ready, put a few thorny branches on the trap or the leopard may jump on the top and spring it. When built it will look small, but if larger the trapped animal will be able to move about and bite at the wood work. Sometimes the claws will be broken and the toes of the leopard lacerated. Evidently it gets on its back and tries to break the upper cross bars. In Chakrata seven leopards were caught in two years in a trap of exactly these dimensions. For sometime only small females were caught but one night a big male was secured. When there is snow on the ground the marks show that the leopard walks round the trap and tries at first to get the bait from the outside.

In some jungles all the leopards seem to be small, which probably gives rise to the idea of the leopard and panther being distinct species, but careful investigation has caused naturalists to dismiss this idea.

The Measurement of Leopards.

As to measurements, the methods employed which are enumerated in the lists given, cause much confusion. There is no doubt that an animal 8 feet length measured between pegs, or even by taping from the nose between the ears and then straight to the tip of the tail, is very rare.

Some fine leopards have been shot in the Maharaja of Cooch Behar's shooting trips, and the Maharaja was enthusiastic over an 8 ft. measurement, and a weight of 154 lbs.

Measurement of dressed skins are not of much value. A leopard with a body measurement of 7′-6″ will probably give a skin over 8′. A 7′-10″ body gave a skin of about 8′-6″.

There are three different methods of measuring tigers and leopards and bears.

1. Rowland Ward advocated driving a peg in at the nose and another at the end of the body and a third at the tail, and measuring from peg to peg.
2. The measurement generally taken is from the nose to between the ears, then a straight line to the end of the body and the tip of the tail.

3. The third is by following the curves of the body from the nose and along the back.

1st Method.

Index No.	Measurement.					
	Sportsman's name.	Length.	Girth.	Height.	Sex.	Locality, etc.
1	A. E. Ward ..	7′-5½″	..	2′-8″	Male	Outer Hills—Weight 120 lbs.
2	Do. ..	7′-2″	..	2′-8″	,,	Outer Hills—Weight 115 lbs.
3	Do. ..	7′-1″	2′-9″	..	,,	Outer Hills—Body, 4′-7″.
4	Do. ..	7′	..	..	,,	....
5	Col. Rowland ..	7′	..	..	,,	Weight 120 lbs.
6	A. E. Ward ..	6′-6″	..	..	Female	,, 90 ,,
7	Trapped ..	6′	..	..	,,	,, 75 ,,

2nd Method.

1	A. E. Ward ..	7′-9″	..	..	Male	....
2	Do. ..	7′-6″	..	..	,,	....

3rd Method.

1	Col. S D. Turnbull ..	7′-10″	3′-1″	2′-8″	Lolab, Kashmir.
2	Do. ..	7′-10″	2′-10″	2′-10″	Handwara, Kashmir.
3	H. E. Malandaine ..	7′-9⅛″	..	..	....
4	S. McDonald ..	7′-9″	..	..	Kashmir.
5	Capt. H. L. Haughton.	7′-7″	..	..	....
6	S. McDonald ..	7′-6″	..	..	Jammu.
7	Major D. G. Oliver ..	7′-6″	..	..	Kashmir.
8	C. R. Radcliffe ..	7′-3″	..	2′-3″	Handwara.
9	Col. S. D. Turnbull ..	7′-3″	..	2′-3″	,,

The head of No. 1 is shown on the plate.

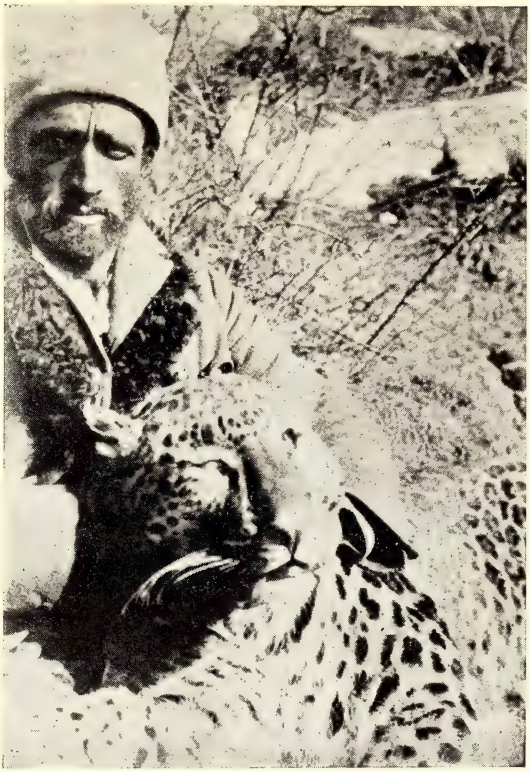
Man-eating Leopards.

A man-eating leopard is a real terror. Every one's experience after man-eaters, whether tigers or leopards, is limited, but, having been engaged in trying to exterminate both species, the opinion has been formed that, of the two, it is easier to get the tiger. In many cases supernatural powers are attributed. A kill occurs, and the next day a second at a distance of 20 miles away. The truth is that the damage is done by a family, not by one beast.

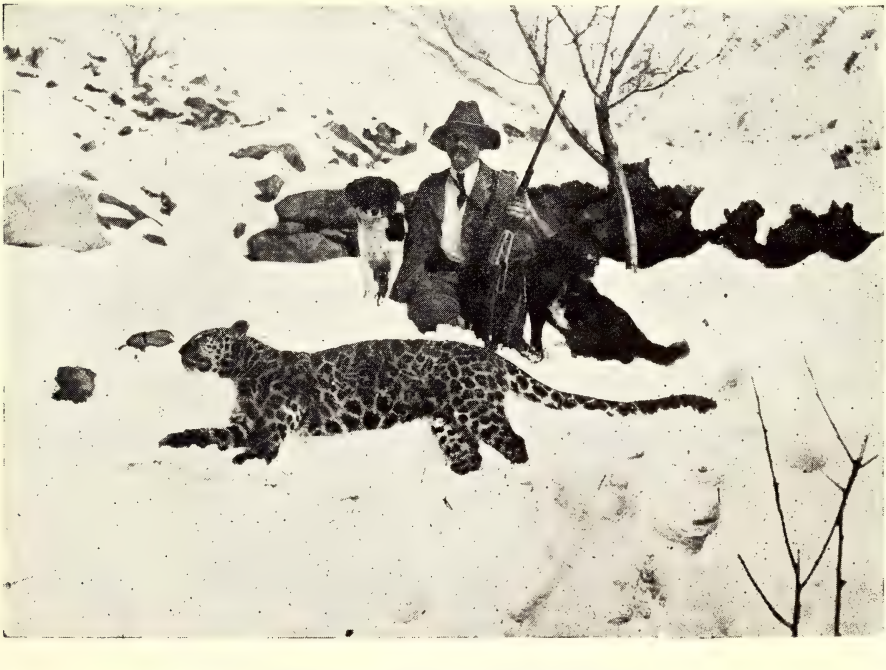
Only once from personal observation has a family of leopards been known to become man-eaters, but it is more than probable that the Almorah list of some hundreds of people destroyed, was not the work of one. The beasts seemed to bear charmed lives and ranged from Almorah to Bhim Tal.

Whilst riding up from Khatgodam railway station, *via* Bhim Tal, the body of a freshly killed woman was found about three miles from the place where the

GAME ANIMALS OF KASHMIR.



THE HEAD OF THE LEOPARD.



LEOPARD SHOT IN THE SNOW.

camp was located. There was ample time to send for a rifle and some rope to make a machan and all was ready before dark. The coolies left and solitude gave a chance of success. Just before dark the noise of talking came nearer, the villagers assembled and took away the corpse and nothing would induce them to wait until morning. On the off chance, as the moon was bright, the vigil was continued, but although the leopard prowled round, it would not show up in the open glade near the machan. The chance was lost. The depredations continued.

An officer in civil employ tried to get information from the Kumaonis near Almorah, but found them reticent. One man actually hinted he preferred the vicinity of the leopard to that of the camp. Another ruffian some days after, actually said by way of excuse, "Sahib, the leopard chiefly takes old women."

Very different was the attitude of the inhabitants of another village—not in Kumaon—where the men petitioned to have some one sent to help them. The time of the year was June, the leopard was in low stone covered hills, where there were any number of hiding places, hence there was no eager volunteering but some one had to be told off to help. The heat in the stony hills was great, but life was bearable under a group of mango trees not far from a village which was at the base of a hill and on the flat ground. It was with the leopard to make the first move, which he did soon. Two days after arrival, a crowd came to the camp and reported that a child had been taken, Between the village and the hill there was a patch of thorny jungle through which a path passed and turned upwards. The leopard might be in this patch, for there were spots of blood in the path leading in that direction. The villagers were in terror, but, by dint of persuasion, a few men, armed with drums of sort, were collected. A guide volunteered to come, whilst "old Gunga," the gun-bearer, marshalled the beaters. He was to stay well outside the thorny scrub until the post was taken up and a handkerchief was waved. Skirting the scrub, the guide led into the hill and reached the pathway about 50 or 60 yards beyond the cover.

The path lay between large fallen rocks, but there was a clear view along it.

Whilst looking for a position above the path the beaters began to drum, and, in a mass, approached the scrub; there was no time to move, for at the first sound the leopard came out at a gallop and headed straight along the path. There was barely time to let off both barrels before the beast had arrived. The impact was unpleasant, for hard stony ground is harder than the back of the human head. The leopard was dead, and as it was coming up hill very little damage occurred. A claw mark on the instep was all the beast could do, and except for the fall matters had gone well, and the pet rifle was not damaged. To get anyone to volunteer to beat was difficult; luckily as it turned out there was no real beat—but where all the people came from when the leopard was dead is a wonder; they crowded round, then put the leopard on a litter, and all the population seemed to possess screaming musical instruments or drums to enliven the ensuing parade. Evidently there was a feeling of relief round the camp.

By the time a wash and rest had come off, Gunga had skinned the leopard; in spite of his efforts to elongate the skin, it only measured 8 feet when pegged out on the ground,—quite a small animal to cause so many deaths.

In the Liddar valley in Kashmir lived a notorious man-eater which was said to have begun by killing boys tending the village goats—anyway it went for a hoatherd who was sleeping in the jungle with a blanket wrapped round him.

The boy, although he died the next day, had to be attended to, so the chance of a shot was lost. Poor little chap, he was bitten at the back of the neck close to the shoulders, probably not much pain was suffered, for beyond an occasional moan no sound was made, nor any movement. From tragedy the matter passed into absurdity. The leopard had on two or three occasions jumped into the upper verandahs of the village houses, and secured his victim. Why not put a shikari with a gun into each house said some officials ?—This was done and for days rapacious men devoured village sheep and fowls. The leopard did not show up, some shots were fired and a dog or two were missed by the shikaris. Wiser counsels however prevailed, and a few men from a Regiment were told off and a crusade against leopards instituted. During the summer two or three were shot, whether the man-eater was amongst them or not no one knew—but peace reigned, the murders ceased, and the small goatherd was the last victim.

A leopard is an uncertain tempered animal, full of craft, but very plucky. Most when wounded will fight, and sometimes when untouched. One was allowed to pass the gun and was fired at as it moved away ; the bullet struck the ground in front of its head, instantly it turned and charged to the foot of the stone on which the gunner was seated. Another which was hit in the body when it had passed, charged back to the ladder of the machan and tried to climb up.

A small leopardess had killed a spotted deer. The elephants were bringing in fodder and the mahouts saw the act. After the loading, the elephants were at once taken back; the pard which was on its kill, at the edge of the jungle, snarled and came at speed close under the leading elephant's trunk. The skin now has a post of honour in the dining room, the measurement was under 6 feet—a plucky little animal.

Three days ago, an eight-point stag was killed by a leopard, the carcase of which was examined. The neck was not broken but there had evidently been a struggle whilst the leopard had fastened on to the throat. The flesh was torn open and the chest and shoulders were much scratched. As a rule the necks of hinds are broken, but it takes a big leopard to break the neck of a stag.

No. 42. The Caracal (*Felis caracal*).

This cat in many ways resembles the lynx, but is not so heavy in build, nor as tall. Although unable to speak with authority, not having come across the Caracal on the Indus, Vigne was most likely correct when he said it was found on the Upper Indus, if he alluded to the river as it flows through Baltistan ; higher up the river it is unlikely to occur, for the cold, which is the life of the lynx, would probably kill the Caracal. There is a caracal skin in Srinagar, which is said to have come from Ladak, and the Balti men knew it as the '*Ech.*'

On two occasions whilst driving low grass jungle for black partridges this animal was shot.

The measurements of these are :—

Measurements.

Index No.	Body.	Tail.	Height.	Locality.	
1	2′-3½″	9″	17″	Western Dun, U. P.	Male.
2	2′-5″	9″	17½″	Punjab.	,,
A cured skin.	2′-7″	11″	..	....	

How far it may be correct to include the Caracal amongst the animals of the hills, with which these articles are concerned, it is difficult to say, but the evidence seems to be in favour of doing so.

The colouring of the hair is practically uniform and may be called a reddish brown, outside the ears are black or hoary, inside white.

Long ago a Punjab Zemindar had a small pack of caracals with which he used to hunt hares, and provided there were not too many bushes the results were good but the hares seemed to be quicker at turning and often got away in spite of the extreme agility of the Caracals.

In Central India another Indian friend had both Hunting Leopards and Caracals, although taken out, the latter were not used, as only black buck were seen.

No. 31. THE OUNCE OR SNOW LEOPARD (*Felis unica*).

The '*Stian*' of Tibet, but generally known as "*Safed Cheetah.*"

The '*Burhel Haye*' towards the eastward of Kumaon—*i.e.*, "The Burhel Killer".

The snow leopard is not a rare animal but owing to its nocturnal habits, and the high elevation at which it lives, very few are shot by sportsmen.

In summer, goats, sheep and occasionally ponies are preyed upon whilst the upland grazing grounds are open to flocks, but in the winter in Kashmir the snow leopard has to live on ibex, musk deer, monal, ram-chikor, etc., for it does not descend to the vicinity of the villages.

In Gilgit, Ladak and Baltistan, numbers are trapped or shot, the skins being sent for sale to Srinagar where high prices are obtained. In winter the villagers catch the Ounce in pits at the bottom of which a kid is put, the sides of the pit slope slightly inwards, in other words the bottom of the pit is wider than at the top. The reason why so many of the skins offered for sale are damaged is because they are often obtained by heaving down stones on the captives.

As far as can be made out after looking up many diaries, it is only on the following occasions that the Ounce was personally seen in a wild state:—

(1) Twice in the Upper Wardwan, when sitting over kills with a friend. One was missed and the other killed.

(2) Once in Kashmir, this Ounce was killed at an elevation of about 12,000 ft. by a long lucky shot close to camp.

(3) Once in the Kriashnye, where the animal was stalking an ibex.

(4) Three in Baltistan at one time, of which two were killed.

(5) One in Kumaon.

(6) Two cubs in the Liddar (on two occasions).

None of these, except the cubs, was below an altitude of 10,000 ft.

On the third occasion the river prevented any attempt at following but through the glasses every movement could be followed as the animal crossed a snow field. It was probably a male for the tail seemed to be very long and thick. The ibex were above and bolted, and the Ounce stood up and returned from whence it had come, evidently disgusted, with its tail erect.

On the sixth occasion the cubs were not caught until later when the goat-herds brought them to Pahkgam in the Liddar. They became quite tame and whilst young romped about with the retrievers, but they got rough in their manners and clawed one dog, after this the retrievers would not go near them. Feeding them at first was very difficult; a mixture of blood and milk, with which once a week a teaspoonful of flowers of sulphur was put, kept the little beasts in good health. Later on a big shelf was put up in the verandah and there the cubs slept during the day. They would jump up and down, time after time, with extraordinary ease. Directly they touched the verandah floor they would twist round and bound back on to the shelf.

As they grew up, rabbits and fowls were given to them. When I was called away to Poonch the snow leopards were in robust health, but on my return after some weeks' absence they were miserably thin; one died and then after a few weeks, the other, whilst under the writing table. Nothing would induce them to climb a tree, and even when the food was placed on a bough they would jump and try and reach it, but would not climb up the trunk.

There are generally two or three snow leopards in the Lalmandi gardens, and Major Wigram for a long time kept one in a big cage under a large chenar tree, but at best the Ounce is not a willing captive and feels the heat of confinement.

Major Wigram's Ounce would press against the bars of the cage and liked having his head stroked, but at times was too free with his claws. Major Oliver also had two which were sent to England.

In a large enclosure with plenty of shade the Ounce would be a lovely creature to watch. Beautiful it certainly is, but it is a most destructive game killer and should be classed as vermin.

Measurements of Snow Leopards.

Index No.	Sportsman's name.	Body.	Tail.	Total Length.	Sex.	Locality.
1	A. E. Ward ..	3′-8″	3′	6′-8″	Male	Kashimir.
	Do. ..	3′-5″	3′	6′-5″	,,	Baltistan.
	Do. ..	3′-3″	2′-9″	6′	Female	,,

One skin which was measured after curing was of exceptional size and attracted much attention. Its total length was 8′-7″, the body being 5′ and the tail 3′-7″.

Frequently the question is asked, "How can I shoot the snow leopard".

Tracking in the snow is not likely to produce much result because the tracks are generally those of the previous evening, or the night, and may lead for miles. Although often tried only once has success attended this method and then only because the morning trail was found and the animals were themselves hunting.

Sitting over a kill of course gives a good chance, but the difficulty of finding a fresh kill is great, and nothing but excessively good luck can help.

The Ounce does not seem to take kindly to tied up goats. Probably if it is known that the game is near at hand the best plan would be to let two or three goats wander about at night and look them up in the early morning. A wolf may kill the goats instead of the snow leopard doing so, or a brown bear may want a meal, but sport may be obtained with any of the three animals.

So few snow leopards are shot that even Major Wigram's records which extend over years could not supply a single measurement.

No. 43. The Lynx (*Felis lynx*).

"*Ee*"

The furriers' shops in Srinagar hold many skins, but very few are shot by those sportsmen who go to Baltistan and Ladak. For years not a single wild one was met with, then one was seen as it stole away not far from Panamek in the Nubra and another which was said to be a cub.

The habitat extends throughout Gilgit, Ladak and Turkestan, from 6,000, to great altitudes.

In captivity the Lynx does well. In former accounts of Ladak game, it was mentioned as having been kept by one of the Viziers of Ladak; it was led on a chain, but at times was very vicious. When poultry or any small animal came near, the Lynx would make a dart to try and make a capture, and having failed it would get into a vile temper, and bite or scratch.

Some very fine skins are brought into Srinagar for sale, at present there are several.

Measurement of a Lynx.

Head and body.	Tail.	(Shot by a friend in Changchemno ♂).
2′-10″	8″	

Measurement of a cured skin.

Head and body.	Tail.	
3′-11″	10″	(A huge specimen).

The Lynx is a powerful animal. On seeing two captive males the weight was guessed at from 50 to 55 lbs. Blanford puts it at 60 lbs.

Major D. G. Oliver brought two lynxes from Ladak and sent them to the Zoo at home. One died and the other was, it is understood, passed on elsewhere.

OTHER CATS.

There are five or perhaps six other skins which are entered in the lists according to size.

The object of roughly describing them here is to enable those who frequent the furrier's shops to have some idea of what they are buying. In order to aid the purchaser the general colouring and length of the cured skins is given.

No. 34. The Golden Cat and varieties.
,, 41. The Jungle Cat.
,, 38. Pallas' Cat.
,, 40. The Waved Cat.
,, 39. The Desert Cat.

No. 34. The Golden Cat (*Felis temmincki*).

The skins of this rather rare cat, which are brought from Nepal and Tibet, vary greatly in colouring, in fact there are two varieties if not three.

The first is of a red colour, with a darker line above the spine. The lower parts are lighter in colour. The underpart of the tail is whitish. The cheeks are marked by a line of white or yellowish white; also near the eye this line is sometimes buff in colour. Ears are black.

The cured skins are rather smaller than those of the caracal with which the furriers seem to confuse them. It is enough to look at the tail. The Caracal has a short tail, the Golden Cat's is generally over 1′-6″.

The deep brown almost black variety comes from Tibet; there are markings on the chest and inside the legs; the underpart of the tail is buff or whitish.

Two skins of the dark golden cat were brought from Nepal to Naini Tal in or about 1913. The would-be purchaser of skins and furs if wise will consult someone who knows the tricks of the trade before purchasing skins, for some are dyed.

No. 41. The Jungle Cat (*Felis chaus*).

Common at all elevations under 7,000 ft., very variable in size.

A common length of the body without tail is 24″ to 26″.

The colouring is in shades of grey varying from yellow to light brownish, some spots are visible. The ears have hairy tips, but not dense as on the ears of the lynx.

No. 38. Pallas' Cat (*Felis manul*).

This cat is found in Ladak, Turkestan and Mongolia.

A live fullgrown male measured:—Body and head 1′-8″, Tail 8½″.

The description is difficult for the hair is not uniform in colouring throughout its length, and this gives the curious silvery appearance mentioned by Blanford.

The skin now lying on the writing table has a general appearance of shades of brown marked with blackish brown on the back, the sides have cross stripes of deep brown. The lower portions are pure white. The limbs in parts are tawny marked with black. The tail grey, thickly ringed with hairs which are partly tawny and black, the tips of these hairs being of either colour. The head is marked with irregular spots. The fur is very dense, silky and long. In the specimen under review there is a white mark, almost semi-circular in shape on the back between the shoulders, but this marking may be a freak. In the Natural History articles a photograph of Pallas' Cat will be included. This was taken from one caught in the Khardong and then sent to England.

No. 40. The Waved Cat (*Felis torquata*).

A very common animal in Kashmir. The furriers call it leopard cat, or '*Chitta Billi*' (spotted cat).

The waved cat is fairly constant in colouring and can be described as grey or greyish brown with dark brown, sometimes black, markings. The chest and stomach are not spotted. Distinct markings on the sides of the head, generally waved not straight. Tail, rather faintly ringed with black with a black tip.

A large skin measured—body and head 2′-2″. The tail being half that measurement.

No. 39. The Desert Cat (*Felis ornata*).

This cat is found in the plains of the Punjab and Sind, and is about the same size as the previous species, but some specimens are large, notably the skin about to be described.

Head and body.	Tail with hair.
2′-1½″	11½″

A yellow sandy colouring throughout, with irregular brownish black spots of different sizes all over. On the legs these markings run into each other until they form three or four almost continuous lines which are black; these lines are less distinctly to be seen on the sides, when they are interspersed by a light tawny colouring. The ears are the same colour as the skin, but are not spotted, they terminate in long hairs at the tips.

There are many skins in the furrier's shops which have simple variations of colouring; other pelts are brought from distant countries.

Being frequently asked "what then is a leopard cat," a description of a very handsome skin is given.

No. 36. The Leopard Cat (*Felis bengalensis*).

This skin is not very large, but is beautifully marked.

Body and head 2′-½″. Tail 10″.

The general colouring is light tawny, with deep black and broad lines on the back merging into black spots on the hind quarters and limbs, but on the legs are three distinct black bars; the lower portions are spotted. The tail is marked with black splotches. A white line extends from the eyes to behind the head. The ears are black outside, and are marked with an irregular white patch, the black forms an edging to the white; the inside of the ear is tawny.

DOGS.

No. 67. The Wolf (*Canis lupus*).

The '*Chanko*' of Ladak.

Some are very large, a big grey male wolf measured.

Head and body.	Tail.
3′-10″	1′-6″

and skins approaching this measurement are not uncommon.

The '*Chanko*' is a persistent game-killer, running singly or in two and threes. Every description of game except the Yak is hunted.

Monsieur Henri Dauvergne came on a small party of wolves which had caught a 'Kyang', the wild ass of Tibet.

Mention was made of a black wolf having been seen (article on Antelopes). The Yak drivers reported that it had come from a cave in a ravine which passed through a flat plain.

The guide led the way, but before reaching the ravine a fine black wolf bolted and went at a gallop across the flat into the hills. As its return was possible, a convenient place was selected in which to hide. The wind was the drawback, and the cause of failure to get a shot. After some time the beast came down from the hills and advanced into the plain, then stood still, evidently suspicious; for hours it was watched as it stood; at last the vigil had to be ended, but, before leaving, the cave was visited and was found to be a broad open-mouthed place which had been used for long. There were many pieces of bone, the skulls and horns of antelopes, and some large bones which were those of the Kyang and Hodgson's sheep. Before leaving Changchenmo a hurried visit was again made and, whilst on the way back to camp, a black wolf with two cubs, one black and the other grey, were viewed; the light was failing and the shot which was a long one, resulted in a miss but, after all, it was luck to see the animals and watch the wolf in the plain for so long.

Wolves bring back memories of two grand Baltistan dogs which were owned by the late Captain J. Y. Allan, an old camp friend, who took several of the photographs which will accompany the Natural History notes.

'Zambur' and 'Bubbems' were the names of these two dogs; they were very fast and staunch, powerful and active. These two dogs once held up a wounded 'Burhel' throughout the night, and Allan owed many a retrieved wounded beast to them.

Age came quickly and the dogs lost their strength, for they were used for hard work. One evening three wolves were seen, and before the dogs could be coupled up, they were off. As the darkness came on 'Bubbems' came back alone, but, Zambur' was never found, and the wolves probably accounted for him. 'Bubbems' lived on for a time but was never of much use, he had been accustomed to hunt in company with his pal and, although he would hold up a wounded beast and bark for a time, he would not stay long alone.

Curiously enough these two dogs never seemed to quarrel, they would feed side by side, and slept in the same enclosure. How often the commandment "Thou shalt not covet " was broken, need not be told. Dozens of hunting dogs have been owned, some good but nearly always vicious, never a pair like 'Zambur' and 'Bubbems'.

On the Yarkand route there are many wolves, which in the caravan season feed on the ponies which die on the track, they also hunt the Burhel, and are said to kill foxes and marmots. In the winter they frequent the villages and are then trapped and shot.

Nocturnal in habit and very shy, they are seldom shot by visitors to Kashmir, Baltistan and Ladak. In Kashmir itself wolves are very scarce, those found near Abbottabad and the lower hills are the Indian Wolf (*C. pallipes*), a destructive beast which is guilty of 'child-killing' and many other sins.

No. 68. The Indian Wolf (*Canis pallipes*).

Throughout the whole of India wolves are found, the number in any one district is luckily small, but now and again the Government has to make special arrangements for their destruction.

It is a very difficult business to rid the country of wolves which have taken to destroying human life, and if the officer on special duty succeeds in getting two or three wolves, he has done well, for the simple reason that they are probably very few, and if he gets a litter of cubs he is lucky.

In Hazara there were wolves which were credited with extraordinary powers, and one in particular was said to be permanently mad, and capable of giving hydrophobia to those whom it bit. Wolves and jackals do of course get hydrophobia, and die, but this beast lived on. It was the same old story, it is a family of animals that do the damage and not a single beast. Nothing could exemplify this more distinctly than was the case with the Chakrata man-eating tigers, these were three in number, the last of which was killed by Mr. B. B. Osmaston after the other two were accounted for.

In the lower hills a pair of wolves were the terror of a secluded village. One wickedness they committed dwells in memory. On the roadside was a grog shop, there a bridal procession stopped, the bride in her litter was placed under a tree, whilst the procession had a drink. The litter coolies fled when the wolves came and the bride was attacked and died from her injuries. Not many days after whilst driving past the village one of the wolves trotted in front of the conveyance for a mile, and then turned off into the forest. It is almost possible to imagine it smiling in derision. One of these wolves was shot during a drive for jungle fowl, the other disappeared, but these two wolves caused many an hour's toil which led to no result.

Is it possible to ride down a wolf, starting off fairly in pursuit ? Probably not, unless by chance the beast is heavy in young or much gorged.

A wolf was speared from horseback, a fine male, but it came off because two fresh horses joined the chase. This is how it occurred. Needless to say the wolf was not in the hills. Four people, one a noted horsewoman, were out looking for the chance of riding after any beast which could run. Two were far out in the plain, the others were nearer the low hills. The outside pair came on a wolf and chased it towards the high ground for about two miles, unluckily for the wolf the riders near the hills spied it and cut across, heading it towards a nullah which was some distance off in the flat country. The fresh horses chiefly took up the running and the wolf was uncertain what to do and again turned towards the hills giving the whole of the pursuers a chance.

Blanford mentions that LeMesurier succeeded in capturing wolves in a pit fall; this was many years ago when Sir John Morris was Chief Commissioner of the Central Provinces before probably nearly all the present readers of the Society's journal were born. An exhibition was held at Jubbulpore, and a wolf was sent by the G. I. P. Railway officials ; of course everyone was shown the man-killing wolf and the worst of characters was given to the beast by the man in charge.

Whether someone by way of a joke opened the cage or the keeper forgot to close it, matters not—anyway the wolf one morning was gone and consternation reigned. How that wolf must have loped off and fled from Jubbulpore ! Did it take with it, disdain of the human race or was it a reformed character forsaking ever afterwards the haunts of man ? Of course every one said how could Mr. H...... (never mind the name), having caught a dangerous beast, have risked its getting loose ; why did he not kill it at once ? But H......when out duck shooting shortly afterwards let out, "there was no reason to suppose the wolf had ever killed man, woman or child".

The whole story would have been forgotten had it not been for an old diary of the far past "Sixties" in the days when Mirzapur was the terminus of the Railway, and the journey from the railhead to Jubbulpore had to be done on horseback or a palki.

No. 70 The Wild Dog (*Cuon dukhunensis*).

"*Ram-hun*" of Kashmiris.

This animal is widely distributed, it inhabits but sparsely the country with which these articles are concerned. Luckily few wild dogs come to Kashmir. It is found on the Indus in Baltistan, and rarely in Ladak.

The colouring of a Baltistan dog is generally very much more tawny than that of the plains animal, it also appears to grow to a larger size.

A full-grown male shot in the Central Provinces measured:—Head and Body 3′-2½″. Brush 1′-5″. Very few wild dogs are shot in Baltistan, but the skin of one, which has a very long brush, measures:

Head and body.	Breadth.	Brush.
3′-8″	1′-9″	1′-9″.

The skull exceeds that of the measurement given by Blanford by fully an inch.

Only on two occasions have wild dogs been personally observed in the vale of Kashmir, once when chukor shooting in Avantipara and the second in the hop gardens, not far from the Wular. In Khru game reserve two half-grown cubs were trapped, and a third was shot in Kulgam.

The wild dogs will, when hunting in packs, pull down any deer; they are not afraid of bears—a leopard takes refuge in a tree,but stories of tigers being attacked should be accepted with caution. However, on 'Xmas day 1912 at Malwan, Kumaon, a tiger's cub measuring 6′-5″ was killed by wild dogs.

Wild dogs hunt by day and by night and as a rule run 'silent.' When living in the Sewalik hills many dogs were observed and also heard. The sound, which is a yap rather than a bark, was heard particularly at night, but whilst riding from Mohani to Badshai Bagh, a sambhar, followed by a pack of wild dogs, crossed the road before dusk; they were giving tongue, and it was a howl of excitement.

In the Mandla district of the Central Provinces, a pack of wild dogs had hunted a stag sambhar into a pool; the deer was in deep water facing the dogs, which were on the bank with the exception of two which had swum out and were on a stone in the river. One was shot and the other missed. The dogs fled and did not return. The sambhar was evidently tired out and sat down in the water with only its back and head showing; after a time it got up and cautiously waded out to the bank opposite where the dogs had been, then stood still for some seconds and apparently, satisfied that the coast was clear, it stole into the forest after moving slowly over the open boulders which bordered the stream.

The plan of attack by the dogs had evidently been frustrated; the two dogs had probably been detached from the pack for a separate advance to be made, for they were up stream above the stag, whilst the other dogs were opposite.

In the Kajnag range of hills, the wild dogs run the markhor when they are in the forest, they also take musk deer and tame animals.

Now and again young buffaloes which are tied up as baits are taken, and when this occurs it is time to move camp, for in the vicinity of wild dogs no game will stay; hence game killing tigers and leopards will have to move also in order to get food.

Whether the wild dog will eat carrion it is hard to say, but they apparently will come to a freshly killed animal, for, as before narrated, two dead wild dogs were encountered close to a pony which had been killed by a tiger.

Except when a tiger beat is in progress, never let a wild dog off, and even then, if it does not spoil some one else's chance of a shot at the tiger, kill the wild dog.

(*To be continued.*)

INDIAN DRAGONFLIES.

BY

MAJOR F. C. FRASER, I.M.S., F.E.S.

(*With 6 Text-figures.*)

(*Continued from page* 910 *of Volume XXVIII.*)

PART XV.

Subfamily—CORDULEGASTERINAE.

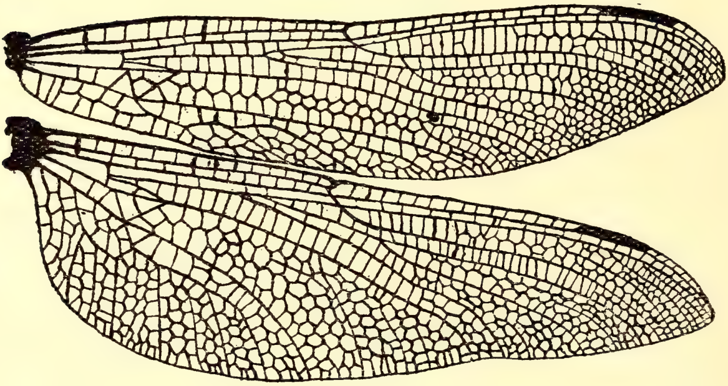


Fig. 1. Wings of *Allogaster latifrons* ♀ (x 2·0).

Head transversely elongate; eyes slightly contiguous or a little separated; occiput not elevated; labium deeper than broad, bifid.

Thorax and legs robust. Wings closely reticulated, long and rather broad; stigma variable, long or short; membrane rather large; trigones closely similar in both fore and hind-wings, made up of 2 to 3 cells; hypertrigones entire or traversed; subtrigones entire; anal border in the male slightly excavate. Abdomen long and robust. Anal appendages of male moderately long, bidentate below, the inferior appendage subquadrate. Vulvar scale very long, extending well beyond end of abdomen. Colours black marked with yellow.

Distribution. Europe, Asia and North America. Within Indian limits restricted to the Himalayas and Kashmir.

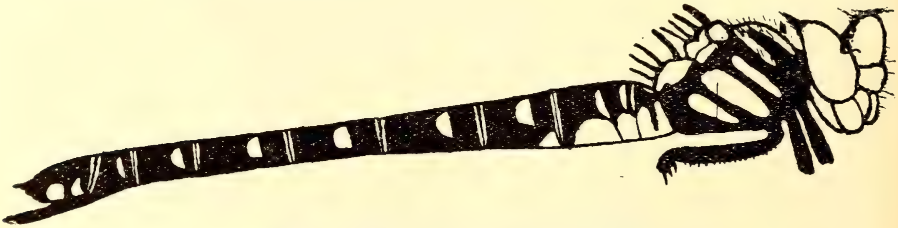


Fig. 2. Markings of *Allogaster latifrons* ♀.

Genus—Allogaster, Selys.

Characters as for the subfamily. Eyes slightly contiguous; frons transverse, nearly as broad as the eyes, markedly raised as seen in profile and on a level with the occiput, depressed just in front of the ocelli. Wings moderately broad, reticulation close; stigma long and slender; trigones short, followed by a single row of 3 cells and then rows of 2; trigones of forewings with 2 to 3 cells, those of hind with 2 only; subtrigones entire. Legs short, femora shortly spined, tibiae spined. Oreillets on 2nd abdominal segment absent. Vulvar scale moderately long.

Ailogaster latifrons, Selys, Bull. Acad. Belg., (2) XLVI., p. 684 (1878); Kirby, Cat. Odon., p. 79 (1890); Williamson, Proc. U. S. Nat. Mus., Vol. xxxi (1907).

Female. (Male unknown).

Abdomen 49 mm. Hindwing 44 mm. Ovipositor 6·5 mm.

Head. Labium, labrum, face and frons brownish yellow, the frons above clouded with very dark brown; vesicle and occiput black, the latter with a yellow spot behind; eyes bordered outwardly with a fringe of long, dark hair, yellow behind, bordered with black above. Face very hairy, especially the frons where the anterior hair is directed forward and the posterior backward.

Prothorax reddish brown.

Thorax very robust, reddish brown, very hairy. Laterally two narrow isolated yellow stripes bordered heavily all round with black. On the dorsum a diffuse black antehumeral stripe. Tergum and chest spotted with yellow (Fig. 2).

Legs black, femora reddish brown except at the distal ends. Hind femora with 2 rows of closely-set evenly spaced spines on the flexor surface; tibiae with long, even spines.

Wings hyaline, slightly ochraceous especially at base and costal border. (In my female, the base and costal border are deep ochraceous and the outer three-fourths of the forewing and outer four-fifths of hind are deeply clouded with blackish brown); trigones of forewing 3-celled, those of hind 2-celled; 3 cubital nervures in all wings; nodal index $\dfrac{16\text{–}18 \mid 17\text{–}15}{16\text{–}14 \mid 15\text{–}15}$; hypertrigones all free; 9 cells in the loop; stigma yellow, over 4-5 cells; membrane whitish (Fig. 1).

Abdomen very thick and robust, very hairy beneath and at base and sides of basal segments, reddish brown beneath, blackish brown above, marked on segments 2–8 with small semilunar subbasal dorsal yellow spots finely separated by the dorsal crest.

Anal appendages short, conical, pointed, dark brown. Situated between hem, a short conical protuberance.

Vulvar scale (ovipositor) of great length, about 1½ times as long as segment 8 and projecting well beyond the end of abdomen.

Type specimen a female in the Selysian collection, taken at Phulloth, Bengal, 6,000 ft., September 1865, by Mr. Atkinson. I know of no other specimen having been taken since except a single female in my own collection taken by Mr. Stevens at Tonglu, Darjeeling District, 11. VIII. 1919. The species is probably locally common or may be rare. Mr. Steven's specimen differs from type by its enfumed wings but I have no doubt that it belongs to the same species.

Genus—Anotogaster, Selys.

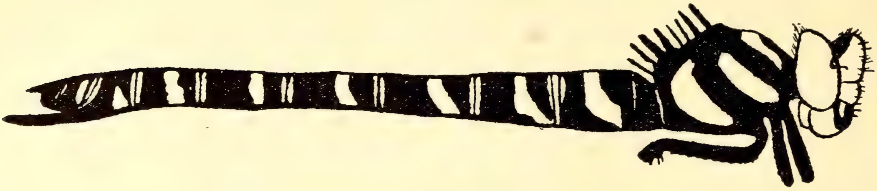


Fig. 3. Markings of *Anotogaster nipalensis* ♀

Characters of subfamily, eyes slightly contiguous; head more globular than transverse: frons raised level with the occiput, wide, but not nearly as much as in *Allogaster*; occiput ridged posteriorily and fringed with very dense, very long black hair. Wings broad, reticulation close; stigma long; trigones in forewings with 2–3 cells, in the hind only 2; subtrigones entire; hypertrigones entire or more usually traversed once; discoidal field commencing with a row of 3 cells and then continued as rows of 2; loop small, of 5-6 cells only; no well-defined anal triangle in the male and none at all in the female. Oreillets on 2nd abdominal segment very rudimentary. Legs rather long and robust, femora with 2 rows of very closely-set, evenly sized, black, backwardly directed spines, tibiæ with closely-set, numerous stunted, blunt spines. (In the female, the femoral spines less numerous, the tibial normal closely-set, gradually lengthening spines).

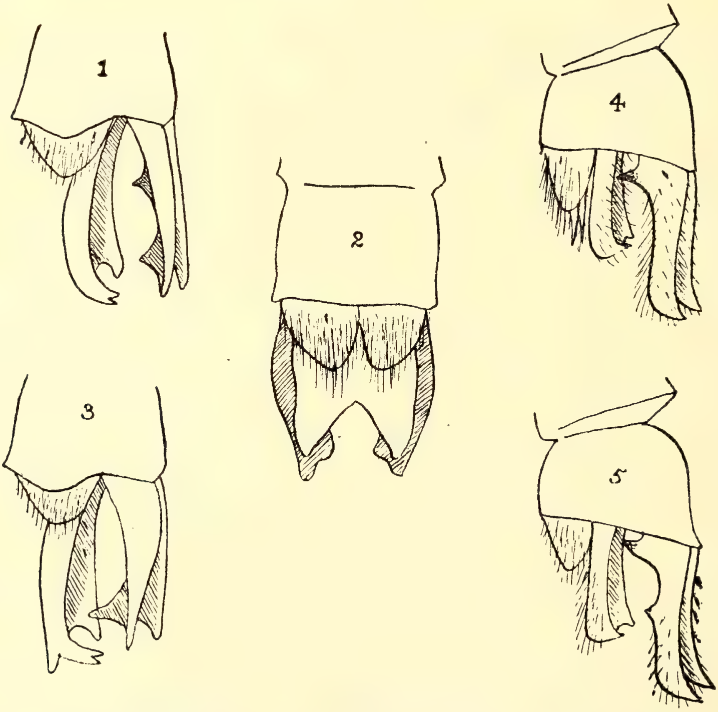


Fig. 4. Anal appendages of:—1. *Orogomphus atkinsoni* Selys, seen from the side. 2. The same seen from below. 3. *Orogomphus speciosus* Selys, side view. 4. *Anotogaster nipalensis* Selys, side view. 5. *Cordulegaster brevistigma* Selys, side view.

Anotogaster basalis, Selys., l. c. xxi. (2), p. 102 (1854); id, xxxvi, (2), p. 507 (1873); Mon. Gomph., p. 323 (1857); Kirby, Cat. Odon., p. 79 (1890); Williamson, l. c.

Female. Abdomen 59 mm. Hindwing 51 mm.

Head. Labrum and face yellow, the former black laterally; epistome black; frons bordered above and in front with black, its upper surface black marked transversely on the crest with yellow; occiput slightly tumid, black, fringed with yellow hairs.

Thorax robust, black marked with yellow as follows:—an antehumeral stripe thicker above than below and converging on its fellow above; laterally two broad yellow stripes widely separated by the ground colour.

Wings hyaline, the basal third of all saffronated; costa yellow; membrane white; stigma dark brown; trigone of forewing 2-3 cells, that of hind with 2 only; hypertrigone traversed once or twice in the forewing, entire in the hind.

Legs black. Abdomen black, marked with a broad yellow annule on each segment from 2 to 8, occupying about one-third of segments 3 to 7, nearly half of segments 2 and 8.

Anal appendages black, short, pointed, hairy. Vulvar scale large, black, yellow at the base and middle.

Male. Abdomen 55 mm. Hindwing 44 mm.

Closely resembles the female but the bases of wings are not saffronated, the labrum has a reddish bordering and is less black laterally.

The epistome is bordered with black in front and the rings on abdomen are less broad.

Type (Female) in the Selysian collection, paratype in Saunder's collection, allotype male in Petrogard Museum, Himalayas.

Anotogaster nipalensis, Selys, Bull. Acad. Belg., xxi. (2), p. 102 (1850); Mon. Gomph., p. 325 (1857); Kirby, Cat. Odon., p. 79 (1890); Williamson, l. c.

Male. Abdomen 54 mm. Hindwing 44 mm. (Fig. 3.)

Head. Labium yellow; labrum black changing to dark yellow along the border, the black enclosing two oblong bright yellow spots; epistome and frons dark yellow or brownish, the upper surface of latter broadly excavate, almost black and covered densely with black hair which also fringes the sides of face; occiput black, fringed densely with stiff short black hairs, this fringe prolonged laterally along borders of eyes.

Prothorax blackish brown.

Thorax very robust, velvety black, very hairy, marked with bright citron yellow as follows:—a short broad antehumeral spot, broadest above where it is barely separated from its fellow by the dorsal carina, pointed below and not nearly reaching the anterior margin of thorax; laterally 2 moderately broad stripes, one posthumeral, the other occupying the centre of metepimeron. In addition some yellow spots on tergum and at bases of wings. Legs black.

Wings hyaline, borders of apices very narrowly enfumed; stigma moderately short, dark brown, over less than 3 cells; costa narrowly yellow as far as node; membrane brownish; trigones in all wings with 2 cells; hypertrigones traversed once in all wings; 2 cubital nervures in all wings; discoidal field begins with 2 or 3 cells and is continued as 2 rows of cells; nodal index $\frac{12\text{–}17 \mid 18\text{–}11}{13\text{–}11 \mid 13\text{–}12}$.

Abdomen. First and second segments and base of third tumid, cylindrical and slender thereafter, gradually thickening as far as segment 8; 9 and 10 short and decreasing in width. Black marked with bright citron yellow as follows:—Yellow annules on segments 2 to 8, those on 2 and 3 connected with lateral basal oblique stripes, all rings except that on segment 2 interrupted by the dorsal crest.

Anal appendages sub-cylindrical, the superior rather longer than segment 10, constricted at the base, pointed at apex. A downwardly and outwardly directed spine on the outer side of extreme base and a similar downwardly and inwardly directed spine on the inner side near the base. Inferior appendage subquadrate, three-fourths the length of superiors, hollowed out above and with two small, upwardly directed spines on each side of the apex (Fig. 4., No. 4).

Female. Abdomen 58-60 mm.; Hindwing 48-50 mm.; Ovipositer 10 mm. Very similar to the male but much more robust. Differs as follows :—Wings hyaline or uniformly and slightly enfumed throughout, the bases of both fore and hind-wings with a basal, sharply defined, golden yellow marking extending as far out as the outermost strong antenodal nervure, apex of trigone and for 8 cells in the anal triangle ; stigma blackish brown ; membrane narrow, brownish black ; nodal index $\frac{16\text{–}20 \mid 21\text{–}13}{13\text{–}14 \mid 13\text{–}14}$; trigones of forewings with 2 to 3 cells (when only 2 cells present, the traversing nervure is distinctly curved), that of hind with 2 cells only; hypertrigones travesed once (entire in forewing of one specimen).

Abdomen very tumid at base and gradually tapering as far as anal end where it is prolonged by the enormously lengthened ovipositor, blackish brown. The 8th segment sharply bevelled posteriorly so that the dorsal surface is only about two-thirds that of the ventral. (This bevelling probably assists the insect when boring or stabbing the muddy bottom of streams with the end of the abdomen during the act of oviposition.)

Hab. Nepal, Darjiling District, Gopaldhara, Assam. I am indebted to Mr. H. Stevens for examples of this magnificent insect, the female of which has not yet been described.

Genus—CORDULEGASTER, Leach.

Characters of the subfamily. Head less transverse than in either of the two preceding genera ; frons less than broad and less raised ; occiput not raised ; eyes barely meeting ; wings moderately narrow and long, reticulation close ; discoidal field beginning with a row of 2 to 3 cells and continued as 2 rows nearly as far as the node ; subtrigones entire ; hypertrigones free ; trigones of forewings traversed once, that of hind entire or traversed once ; stigma variable. Oreillets present on 2nd abdominal segment of male. Hind femora with two rows of very short, very closely-set spines ; tibial spines very numerous, variable in size Vulvar scale moderately long, 6·8 mm. in *brevistigma.*

Cordulegaster brevistigma, Selys, Mon. Gomph., p. 58 (1857) ; Kirby, Cat. Odon., p. 70 (1890) ; Williamson, Proc. U. S. Nat. Mus., xxxii., pp. 276-278 (1907).

Thecagaster brevistigma, Selys., Bull. Acad. Belg., xxi., (2), p. 103 (1854).

Male. Abdomen 54 mm. Hindwing 42 mm.

Head. Labium ochreous as also are the mandibles and corners of mouth ; labrum greenish yellow finely bordered with black and with a median tongue of the same colour running from the centre of base to the lower border of lip which however it falls short of ; epistome greenish-yellow bordered with black below ; frons golden yellow traversed by a narrow horizontal black line ; vertex and occiput black, the latter fringed with yellowish hairs ; back of occiput and eyes yellow with a large basal spot of black on the latter.

Thorax black marked with pale yellowish green as follows :— two cuneiform antehumeral stripes, broad above where they converge towards one another, narrowing below ; laterally two broad yellow bands not extending to the legs below but nearly to the wings above, the anterior with a straight anterior border and crenulate posterior, the posterior occupying the posterior two-thirds of the metepimeron.

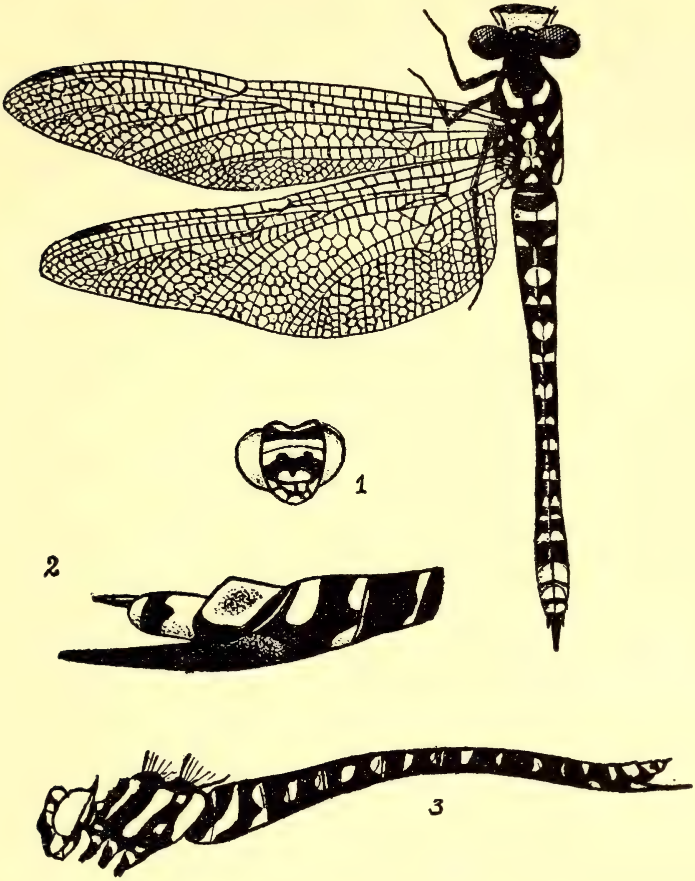


Fig. 5. *Cordulegaster brevistigma*, Selys. 1. Head seen from the front. 2. Terminal segments of abdomen and ovipositor. 3. Side view showing markings.

Between these two bands, rudiments of a third represented by an upper and lower small spot of yellow. A small spot at bases of trochanters.

Legs black.

Abdomen subcylindrical, triquetral, tumid at base, slightly constricted at the third segment, blackish brown marked with bright citron yellow as follows :—a lateral spot on segment 1, an apical and a medial ring on segment 2, the latter sloping down and forwards to meet the lateral spot on segment 1 (occasionally the lateral marking is separated from the dorsal medial ring), the latter entire or interrupted at its middle on the dorsal carina, the apical ring entire. Segment 3 with an irregular lateral basal mark, two middorsal spots roughly triangular in shape and two apical lunules, both pairs of spots meeting over the dorsum with those on the opposite side, segments 4 to 8 with similar dorsal spots and apical lunules, the former slightly separated on segment 4 and gradually more so from 5 to 8, the latter gradually narrowing from 4 to 8 and separated on the dorsum from 6 to 8. Segment 9 with only traces of apical lunules and a pair of angulated spots at the base, segment 10 with basal half and extreme apex yellow.

Superior anal appendages as long as segment 10, tapered, sloping strongly downward and with the apices turned up, beneath furnished with a basal and a submedian tooth; inferior quadrate, the apex shallowly but broadly notched (Fig. 4, No. 5.).

Wings hyaline; stigma black, that of forewing 3 mm. in length, that of hind 4 mm.; trigone traversed or entire in all wings; one cubital nervure in all wings; nodal index $\frac{9\text{–}15 \mid 15\text{–}9}{10\text{–}11 \mid 10\text{–}10}$; *reticulation moderately open.*

Female similar to male but wings palely saffronated at the base and along whole length of costal margin. The black band on frons much broader than in the male. Abdominal segment 9 entirely yellow; nodal index $\frac{12\text{–}18 \mid 16\text{–}12}{12\text{–}12 \mid 12\text{–}12}$; $\frac{13\text{–}16 \mid 16\text{–}12}{13\text{–}13 \mid 12\text{–}14}$; vulvar scale of great length, blackish brown, yellow at base.

This species is readily distinguished from the following by the more open reticulation of the wings and by the face being marked conspicuously with black. The character of the trigones varies, they are as often free as traversed (once) in the male. In the female they are invariably traversed once in the forewings but in the hind may consist of 3 cells by the confluence of three nervures at the centre of trigone. Selys gives as a character the number of antenodal nervures, which he states are fewer in *brevistigma* than in *parvistigma.* The latter species was however described from a female and it will be seen from above that the antenodals in the female of *brevistigma* are considerably more than in the male of the same species so that this character is purely a sexual one and will not stand as a distinguishing character.

Hab. Mashobra Hill, Simla Hill States, 7,000 ft. Type male in the Saunder's collection, cotype female in the British Museum. I am indebted to the Indian Museum for the loan of specimens of this and the following insect which were collected by Mrs. and Dr. S. Kemp, vi, 1921. Mr. O. Lindgren has also sent me a female of *brevistigma* from Turzum near Darjeeling and Mr. Rishworth another of the same sex from Simla.

Cordulegaster parvistigma, Selys, Bull. Acad. Belg. (2), xxxvi., p. 508 (1873); Kirby, Cat. Odon., p. 79 (1890); Williamson, Proc. U. S. Nat. Mus., xxxii., pp. 276-277 (1907).

Male. Abdomen 51 mm. Hindwing 40 mm.

Head. Labium, labrum, epistome and frons yellowish, unmarked; occiput yellow fringed with longish yellow hair.

Thorax black marked with yellowish green as in *brevistigma.*

Abdomen black marked with bright citron yellow as in *brevistigma* but the median spots on segments 7 and 8 and those on 9 and 10 smaller. Legs black marked with yellow outwardly on the femora.

Wings hyaline, *reticulation moderately close,* decidedly closer than in *brevistigma*; trigones traversed once in all wings; 1 cubital nervure in forewing, 2 in the hind; nodal index $\frac{14\text{–}17 \mid 16\text{–}13}{16\text{–}12 \mid 12\text{–}15}$; $\frac{12\text{–}18 \mid 17\text{–}12}{13\text{–}14 \mid 15\text{–}14}$; $\frac{13\text{–}16 \mid 16\text{–}11}{13\text{–}12 \mid 12\text{–}15}$.

Anal appendages black exactly similar to those of *brevistigma.*

Female closely similar to the male, the wings saffronated at the base; trigone traversed once in the forewing, made up of 3 cells in the hind by 3 nervures which are confluent at centre of trigone; nodal index 11-21, 21-11.

Abdomen similarly marked to that of *brevistigma* but the 10th segment unmarked.

The specimens kindly sent me by Dr. Kemp were collected at Baghi, Simla Hill States, 8,800 ft., x. 21. *C. brevistigma* and *parvistigma* are very closely allied, the latter differing from the former by its unmarked face and closer reticulation.

Cordulegaster bidentatus, Selys, Ann. Soc. Ent. de Fran., vi., 1843; Bull, Acad. Brux., 1843; Rev., Odon. d'Europe, p. 187; Bull., Acad. Belg., xxi., (2), p. 106 (1854); (2) xxxvi., p. 509 (1873); Mon. Gomph., p. 339 (1857); Ann, Soc. Ent., Belg., xxxi., p. 34 (1887); Kirby, Cat Odon., p. 81 (1890); Calvert., Proc. Acad. Nat. Sciences Phil., 141 (1898).

Cordulegaster annulatus (pars) Selys, Mon. Gomph., p. 596 (1857); Mon. Lib. Europe, p. 104 (1850).

Cordulegaster pictus, Selys, Syn. Gomph., p. 87 (1854); Mon. Gomph., p. 599 (1857).

Male. Abdomen 50-56 mm. Hindwing 42-45 mm.

Head. Labium yellow, unmarked; labrum yellow finely bordered with black and with a tongue-like process of black running from the base at its centre but not reaching the anterior border; epistome black below, yellow above, the black invading this on either side as a small point; frons yellow traversed by a band of black which expands at both ends, its base above narrowly bordered with black. Occiput black bordered with a very dense fringe of yellow hairs, behind two well defined round spots of yellow; vesicle black.

Prothorax black spotted with yellow on the dorsum and sides.

Thorax black, marked exactly the same as in *brevistigma.* The yellow however is of a deeper tint and more ochreous, also the spots between the two lateral stripes are more reduced, often not more than an upper point. Laterally and dorsally thorax coated with whitish hairs.

Wings hyaline; stigma black, moderately long; trigones traversed once or occasionally entire; one cubital nervure in the forewing, 2 in the hind; costa outwardly yellow; anal triangle composed of 2 or 3 cells; nodal index

$$\frac{10\text{–}17 \mid 15\text{–}11}{11\text{–}13 \mid 12\text{–}12}.$$

Legs black, hind and middle femora with a row of short, very closely-set spines; tibia with short blunt and even more closely-set spines.

Abdomen black marked with ochreous yellow as follows:—Segment 1 with a lateral spot, segment 2 with an apical dorsal lunule finely separated from its fellow by the dorsal carina, an apical spot low down on the side and a median annule which broadens laterally as it traverses the oreillets; segments 3 to 8 with median lunules separated by the dorsal carina, on 7 and 8 these lunules extend down the side and are confluent across the ventrum with those from the opposite side, segment 3 and sometimes 4 also have fine apical annules, segment 9 with a very small lateral spot at the base, segment 10 unmarked.

Superior anal appendages markedly divaricate, as long as segment 10, narrow at the base, black, at the middle furnished with an inwardly and downwardly directed tooth. Towards the basal fourth, a second tooth situated laterally and directed basalward. Inferior appendage about three-fourths the length of superior, rather longer than broad, very slightly notched at apex, black.

Female. Abdomen 55 mm. Hindwing 49 mm.

Similar to male but differing in the following respects:—

Labium with a broader border of black, the basal tongue of black prolonged to meet the black border of labium so that the ground colour is split up into two yellow spots.

Vulvar scale black unmarked with yellow at the base. Annules on 8th abdominal segment widely interrupted and very narrow.

Hab. Calvert has reported this species from Kashmir which is the only locality within Indian limits where it has so far been found. Kashmir specimens do not differ in any respect from European ones. The above description has been made from a male kindly presented to me by Mr. Kenneth Morton of Edinburgh and was taken in the Bass Alps, Pyrenees. Found throughout middle and southern Europe in montane areas, also probably throughout Central Asia.

Genus—OROGOMPHUS, Selys.

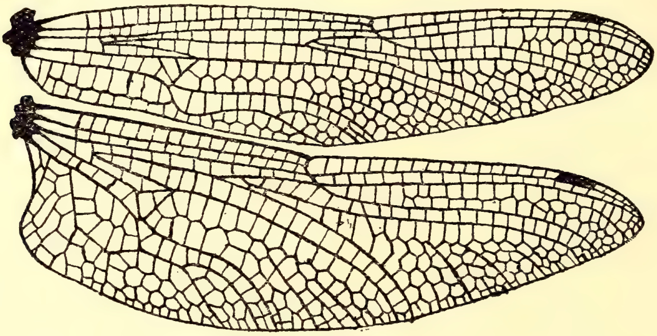


Fig. 6. Wings of *Orogomphus atkinsoni*, Selys, Male (x 2·0).

Orogomphus, Selys, Bull. Acad. Belg., (2) xlvi., p. 681 (1878).

Head transversely elongate ; eyes slightly separated or meeting only at a point ; frons elevated ; face very broad.

Thorax robust ; abdomen slender, slightly compressed, much longer than the wings ; anal appendages of male analagous to those of *Cordulegaster.* Wings very broad ; basal space (prearcular) traversed ; trigones traversed, that of forewing composed of 2 to 3 cells, its inner side shorter than the others, that of hindwing with the costal side equal to the basal, the outer side slightly longer ; stigma very short, slender. Vulvar scale very short.

Three species found within Indian limits,—*O. atkinsoni* Selys, *O. speciosus* Selys ; and *O. xanthoptera,* Fraser.

Orogomphus atkinsoni, Selys, Bull. Acad. Belg., (2) XLVI p. 682 (1878); Kirby, Cat. Odon., p. 79 (1890); Selys, Ann. Mus. Civ. Genova, (2) x., pp. 481–482 (1891) ; Williamson, Proc. U. S. Nat. Mus., xxxii., pp. 278–279, fig. 5–6 (1907) ; Laid., Proc. Zool. Soc. Lond., pp. 61-62 (1914) ; Id., Rec. Ind. Mus., Vol. xi., pp. 197–198 (1915).

Male. Abdomen 58 mm. ; Hindwing 41 mm. (Fig. 6).

Head. Eyes just meeting at a point, bottle green, narrow and elongate ; labium bright yellow ; labrum, face and frons brownish yellow, the face very flat, frons remarkably broad and elevated, blackish brown above ; vesicle black ; occiput brown fringed with a ruff of stiff yellowish hairs.

Prothorax black, its base, 2 median transverse spots, and the posterior border yellow.

Thorax blackish brown marked with bright greenish yellow as follows :—A pair of antehumeral stripes on the dorsum, very broad and confluent above, tapering to a point below. Laterally two moderately narrow stripes, one posthumeral, the other on centre of metepimeron. Between these and close to base of wings, a small spot of yellow.

Legs black, anterior pair of femora pale brown inwardly. Hind and mid femora with a row of very minute, very closely-set spines; tibial spines fine and not very numerous.

Wings hyaline, reticulation close, moderately narrow, much shorter than abdomen. Stigma black, inner end not oblique, not braced, over 2 to 3 cells. Membrane small, cinereous; trigones traversed by a curved nervure; 6 to 7 cubital nervures in all wings; basal space traversed once in all wings; nodal index $\frac{12\text{–}22 \mid 22\text{–}11}{16\text{–}17 \mid 17\text{–}13}$; hypertrigones traversed 3 times in all wings; *Rspl.* and *Mspl.* absent; 6 to 7 supplementary nervures to bridge; 9 cells in loop; anal triangle of 2 to 3 cells.

Abdomen very long and slender, segments 1 to 3 tumid, 8 slightly dilated, black marked with yellow as follows:—Segment 1 unmarked, its dorsum and that of segment 2 coated with yellow hairs; segment 2 with an apical annule, the oreillet and a ventral streak on the border yellow; segments 3 and 4 with narrow apical lunules and a small subdorsal spot about the middle of segment; segments 5 to 7 with only the apical annule; remaining segments black, unmarked.

Anal appendages black, the superior slightly divaricate, very broad at base and thickened, flattened apically and quadrate at extreme end.

A small downwardly directed spine about the middle. Inferior as long as superiors, quadrate, deeply concave above, rather deeply notched at apex (Fig. 4, Nos. 1 and 2).

In one of the males kindly sent to me by Mr. H. Stevens from Gopaldhara, Assam, there is the most extraordinary complexity of reticulation of left wings, especially of left forewing where the nervures here and there are seen to throw out branches in all directions, whilst the base of the wing is a complex network of fine veins.

Female. Abdomen 58 mm. Hindwing 45 mm.

Very similar to male. Wings hyaline, saffronated at base as far out as the first antenodal nervure; trigone of forewing with 2 cells, that of the hind with 3 formed by confluence of three nervures at the centre of trigone; nodal index similar to that of male.

Between the two lateral stripes on thorax are three yellow spots.

Abdomen cylindrical, very tumid at base, segments 3 and 4 distinctly narrower than the others. Yellow markings rather more pronounced than in the male. Border of segments below narrowly margined with yellow. Anal appendages small, black, cylindrical, separated by a conical protuberance thickly coated with yellow hairs.

Vulvar scale short, tongue-like, projecting slightly beyond end of 10th segment.

Hab. Bengal and Assam. I am indebted to Mr. H. Stevens for examples of this fine insect. Mr. T. Bainbrigge Fletcher has taken it at Kurseong where also he has found the exuvia in numbers clinging to rocks.

On a first examination of these I was so struck by the close resemblance of the larvæ to that of *Cordulegaster annulata* that I came to the conclusion they must be *Cordulegaster brevistigma*, Selys. Unfortunately in none of the exuvia sent could the venation be deciphered. Mr. Fletcher then very kindly placed more material at my disposal and in three of these the main nervures are fairly distinct. The nervure *Cui* is strongly curved as in *Orogomphus* and thus throws out *Cordulegaster* in which it is almost flat. Mr. Fletcher informs me that *Orogomphus atkinsoni* was quite common flying about at the time he found the exuvia. The extraordinary close resemblance between the two larvæ serves to show that there is a much closer relationship between the two genera than was hitherto thought to exist. The exuvia mentioned above will be described in the "Memoirs of Pusa."

Orogomphus speciosus, Selys, Ann. Mus. Civ. Genova (2), x., pp. 481-482 (1891); Williamson, Proc. U. S. Nat. Mus., xxxii., pp. 278-279, fig. 5-6 (1907); Laid. Rec. Ind. Mus., Vol. xi., p. 198 (1915).

Male. Abdomen 54 mm. Hindwing 40 mm.

Head very broad (10 mm.); eyes more distinctly separated than in *atkinsoni*; labium and labial palps yellow; labium black enclosing two small yellow spots; epistome citron yellow; frons and vertex black but the frons has a fine transverse line on its upper part (and is less elevated and less broad than in *atkinsoni*); occiput black fringed with very long black hairs.

Prothorax black marked with 2 median spots and the posterior border yellow.

Thorax black marked with bright yellow as follows:—an antehumeral and a juxtahumeral stripe curving towards each other, laterally 3 yellow stripes of which the middle one is the broader. Beneath yellow marked obscurely with longitudinal brownish marks.

Abdomen much longer than wings, cylindrical, slender but tumid at base and segments 7 to 9. Black marked with yellow as follows:—segment 1 with an apical and lateral spot; segment 2 largely yellow with a transverse central black mark; segments 3 to 6 with apical spots and the 3rd with an additional fine yellow line on the median suture; on segment 7 the apical spot broader, whilst the remaining segments are quite unmarked. Beneath, sutures all yellow.

Wings hyaline; stigma small, slender, black, over 2½ to 3 cells; nodal index $\frac{11\text{–}22 \mid 21\text{–}12}{16\text{–}20 \mid 22\text{–}15}$; only one prearcular nervure to all wings; 7 cubital nervures in forewing 5-6 in the hind; trigone traversed only once in all wings; hypertrigone traversed 3 to 4 times; membrane black.

Anal appendages black, somewhat similar to those of *O. atkinsoni*. Superior stout, a little shorter than the inferior, convergent, slightly bifid at the apex. The median ventral spine present in *atkinsoni* is merely represented by a tiny tubercle scarcely visible in profile.

Inferior stout, bifid, each arm curled up at the apex which ends in a doubly toothed point. Beyond the curled up portion a small spur projects straight back. (Fig. 4, No. 3).

Female very similar to male, differs as follows:—

Abdomen 57 mm., Hindwing 46 mm.

Hindwing broader than that of male; 2 prearcular nervures to all wings; $\frac{13\text{–}22 \mid 23\text{–}13}{17\text{–}17 \mid 19\text{–}17}$; 7 to 8 cubital nervures; trigone traversed once in the forewing, composed of 3 cells in the hind by the convergence of 3 nervures to centre of trigone; hypertrigones traversed 4 times.

Occiput yellow. Segment 2 of abdomen black marked with narrow basal lunules and a broader apical annule. A large yellow spot on the sides of same segment; segment 8 has also an apical lateral spot of yellow.

Hab. Bengal and Burma. Type female in the Selysian collection, March, Taho, Burma . Cotype male in Lord Cramichael's collection (Darjeeling district) 1,000 to 3,000 ft., May 1912.

Orogomphus xanthoptera, Fraser, Journ. Bomb. Nat. Hist. Soc., Vol. xxvi, No. 3. pp. 874-875, 20. x. 1919.

Female. (Male unknown) Abdomen 54 mm. Hindwing 56 mm.

Head very broad and flattened from before back; labrum, labium and epistome bright yellow; frons very high, higher than the occiput, yellow in front and above where is a broad diffuse dark brown basal line ; occiput black fringed with stout yellow hairs.

Prothorax very small, brown.

Thorax brownish black marked with yellow as follows :—a vestigial antehumeral stripe which is connected to a converging humeral stripe above, forming a hook-like marking with it, laterally two broad stripes, one beneath the forewing, the other on the posterior part of metepimeron.

Wings deeply and evenly saffronated throughout but the cell middles are hyaline ; hindwing nearly twice the breadth of fore (20·5mm.) ; stigma black, short, over 3 cells ; nodal index $\frac{13\text{–}24 \mid 23\text{–}13}{16\text{–}18 \mid 18\text{–}16}$; 4 prearcular nervures in forewing, 3 in the hind ; 9 cubital nervures in the forewing, 8 in the hind ; hypertrigones traversed 4 to 5 times ; trigone of forewing with 3 cells, 5 in the hind (3 cells is probably more common) ; 22 cells in the loop ; membrane almost absent.

Abdomen tumid at base, segments 3 to 6 narrow, apical half of 7 and whole of 8 and 9 dilated, tapering to the 10th which is very small.

Black marked with yellow as follows :—segment 1 with a triangular spot on the dorsum and the sides broadly ; segment 2 with small transverse lunules on the middorsum, a basal line and the sides broadly ; segment 3 similarly marked, 4 to 7 with dorsal lunules only, remaining segments unmarked. Legs black unmarked.

Anal appendages black, small, cylindrical. Vulvar scale broad and depressed, slightly overlapping the 9th ventral plate.

Hab. A single female from the Palni Hills, Madura District, S. India, collected by Mr. Prater, 1917. Type now in the British Museum.

Mr. Campion who has kindly examined and photographed this unique insect expresses the opinion that it is more nearly allied to *Chlorogomphus* than *Orogomphus* but the two genera are doubtfully distinct. (For figure of wings, see Journal Bomb. Nat. Hist. Soc., l. c.).

(*To be continued.*)

DRAGONFLY COLLECTING IN INDIA.

BY

Major F. C. Fraser, I.M.S., F.E.S.

Part II

(*With two text-figures.*)

(*Continued from page* 898 *of Vol. XXVIII.*)

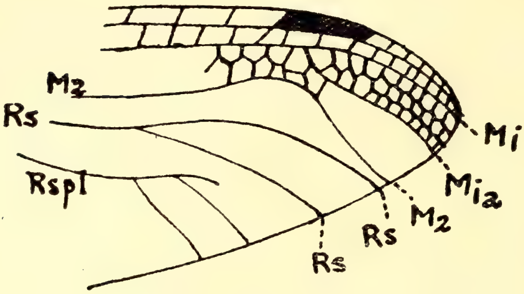


Fig. A.

Fig. A. Diagram of apex of wing showing :—
Rs bifurcating as in *Æschna.* *Mii* making an abrupt curve towards the stigma as in *Anax.* Two rows of cells between *Mi* and *Mia* at outer end of stigma as in most species of *Gomphus* (3 rows in *Heterogomphus*). The stigma braced. *Rspl* present.

The present part deals with the key to the whole of the Suborder *Anisoptera,* the key to the remaining Suborder *Zygoptera* forming Part III of this article. (Indian species only.)

I have included all the keys that have appeared in "Indian Dragonflies", but have made extensive alterations, aiming first at simplicity and secondly at deleting all the Mesopotamian species which have appeared in those keys. During the late war, Mesopotamia became politically a part of India, it no longer is so and all the entomologists who went there from this country have now left it so that interest in its fauna has died down. In a zoographical sense its dragonfly fauna had few relations with India and on this ground alone it is better to remove them from our list.

In the key I have added not only all new species which have since been described but also others, the descriptions of which will shortly be published and other species, which although not new, have since been recorded from within Indian limits, thus the list will be practically up to date at the time when it appears in print.

The way new species have come to light during the past two years has been perfectly amazing and serves to show how little work has been done upon the dragonfly fauna of this country. A good number of corrections in the keys has been made, these having been detected in the course of revision. I have also found the necessity of adding a few more diagrams in this part, to aid the amateur in the working of the key, which as will be seen is mainly a dichotomous one.

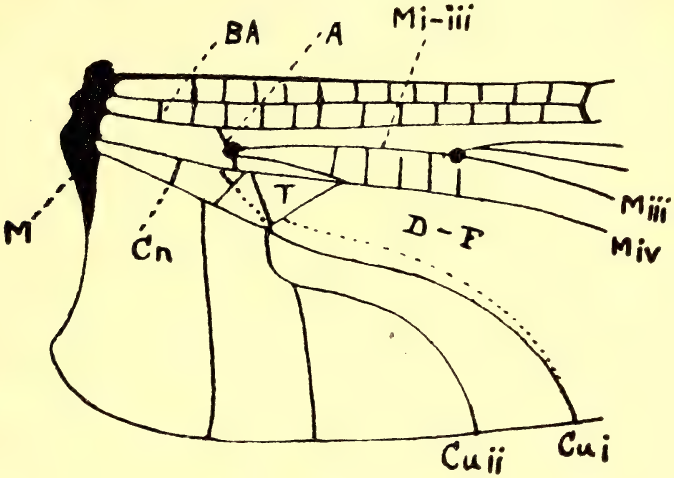


Fig. B.

Fig. B. Diagram of base of wing showing :—

M membrane; Cn=cubital nervure; T=trigone; D-F=Discoidal field; BA=Basal antenodal nervure of second series; A=Arc, *Mi-iii*=the part of *Miii* running between the two dots, that is, from the arc to where the nervure bifurcates.

The trigone is shown as *distal to the arc,* but the dotted line indicates its position if proximal to the arc. *Cui* is shown as arising from the posterior angle of the trigone, but the dotted line indicates its position when arising distad to the angle.

Four nervures are shown lying between *Mi-iii* and *Miv* as in *Heliogomphus,* etc.

Order—ODONATA.

1. Suborder—*Anisoptera* :—
Wings always held more or less horizontally wide open when the insect is at rest, unequal, the hind much broader at the base than the fore; the discoidal cell triangular in shape, often differing in shape in the two wings; eyes variable, contiguous or separated, more often contiguous. Male with two superior anal appendages, the inferior usually fused, the female with only two superior anal appendages, no inferior.
Larvæ without caudal gills, rectal gills only 2

1. Suborder—*Zygoptera* :—
Wings held folded together over the back when the insect is at rest (the *Lestidæ* hold the wings half-open when at rest, *Philoganga* holds them quite open when at rest); wings similar in shape, the hind sometimes broader than the fore but the base never broadened; the discoidal cell a simple regular or irregular *quadrilateral*, entire or traversed by one or several nervures, sometimes pointed externally but always four-sided; eyes always well separated; male with two superior and two inferior anal appendages, the female with two inferior appendages only..
Larvæ with two or three caudal gills, sometimes with lateral abdominal gills also 198

2. Family—*Libellulidæ* :—
Trigones of fore and hind wings dissimilar in shape and placed at unequal distances from the arc; antenodal nervures of first and second series corresponding; labium (lower lip) with a small median lobe and two broad lateral lobes overlapping it; ocelli arranged in a triangle around the vesicle 3
Family—*Æschnidæ* :—
Trigones of fore and hind wings similar or nearly similar in shape and placed at equal distances from the arc; antenodal nervures of first and second series not corresponding (except for occasional individuals); labium with middle lobe about equal in size to lateral lobes and not overlapped by same; ocelli arranged in a transverse line in front of vesicle 94

3. Subfamily *Libellulinæ* :—
Anal border of hindwing of male more or less rounded; no auricles on sides of second abdominal segment of male; anal appendages very simple and similar in the genera; body colour nearly always non-metallic; tibiæ of forelegs without a keel-like ridge 4
Subfamily—*Corduliinæ* :—
Anal border of hindwing in the male angulated or excavated (except *Hemicordulia*); auricles present on sides of second abdominal segment of male; anal appendages often highly specialized in the genera; body colour metallic; tibiæ of forelegs with a keel-like ridge 76

4. Trigone of forewing poorly developed, four-sided due to a bend or angulation in its costal side (anterior side). Loop poorly developed or absent; discoidal field begins with a single row of cells 5
Trigone of forewing well developed and only three-sided; loop well developed; discoidal field begins with a two rows of cells 9

5. Genus—*Hylæothemis* :—
Trigone of hindwing traversed by a nervure .. *Hylæothemis fruhstorferi.*
Trigone of hindwing free 6

6. Genus—*Tetrathemis* :—
Loop present but poorly developed; antenodal nervures to forewing 7-9 in number; arc between antenodal nervures 1 and 2 7
Genus—*Palæothemis* :—
Loop absent in the male, poorly developed or absent in the female; antenodal nervures 10-12 in number; arc between antenodal nervures 2 and 3 .. ..*Palæothemis tillyardi.*
Genus—*Nannophya* :—
Loop absent in both sexes; antenodal nervures only 5 in number; arc between antenodal nervures 1 and 2 .. ..*Nannophya pygmæa.*

7. Wings of male with saffronated markings 8
Wings of male without saffronated markings ..*Tetrathemis yerburyi.*

8. Base of wings of male as far as node golden yellow (slightly marked only in young specimens) .. ..*Tetrathemis platyptera.*
The wings clouded with golden yellow about the node in both, this colour extending as far as the stigma in the hindwing but more limited in the fore .. ..*Tetrathemis aurea.*

9. Genus—*Palpopleura* :—
Costal margin of forewing proximal to the node sinuously curved; wings marked with golden yellow and black; small species .. ..*Palpopleura sexmaculata*
Costal margin of forewing straight 10

10. Nearly always supplementary nervures to the bridge and more than one cubital nervure to the hindwing 11
Only one nervure to the bridge and not more than one cubital nervure in the hindwing 23

11. Genus—*Cratilla* :—
Thorax partly or wholly metallic; discoidal field beginning with 3 rows of cells 12
Genus—*Libellula* :—
Thorax non-metallic; discoidal field beginning with 3 rows of cells. (Species from N. E. India and Kashmir) 13
Thorax non-metallic; discoidal field beginning with 2 rows of cells (except in occasional species of *Lyriothemis*) 14

12. Thorax partly metallic; apices of wings hyaline. *Cratilla lineata.*
Thorax wholly metallic; apices of wings black...*Cratilla metallica.*

13. Wings with a spot of brown at the node and another at the stigma; membrane white *Libellula quadrimaculata.*
Wings unspotted; membrane black .. ..*Libellula fulva.*

14. Genus—*Agrionoptera* :—
Eyes broadly contiguous .. ..*Agrinoptera insignis.*
Eyes meeting only at a point 15

15. Genus—*Amphithemis* :—
Trigone in forewing entire eighth nervure not arising from the posterior angle of trigone in

the hindwing; eighth abdominal segment in the female not dilated; abdomen slim and cylindrical 16
Genus—*Lyriothemis* :—
15. Trigone in forewing traversed once; eighth nervure arising from the posterior angle of trigone in hindwing; eighth abdominal segment in female dilated laterally; abdomen broad and stout 19

16. Discoidal field beginning with only a single row of cells .. ..*Amphithemis mariæ.*
Discoidal field beginning with 2 rows of cells 17

17. Abdomen short and cylindrical, red; superior anal appendages only slightly longer than the inferior .. .. *Amphithemis curvistyla.*
Abdomen long and slim, yellow and black 18

18. Superior anal appendages at least twice as long as inferior; abdomen longer than the hindwing *Amphithemis vacillans.*
Superior anal appendages only slightly longer than the inferior; abdomen and hindwing of the same length .. ..*Amphithemis nigricolor.*

19. Small species with 9-11 antenodal nervures to forewing; loop short 20
Large species with 13-19 antenodal nervures to forewing; loop long 21

20. Yellow antehumeral spots on thorax convergent above .. ..*Lyriothemis acigastra.*
Antehumeral spots not convergent above ..*Lyriothemis mortoni.*

21. Two to 3 cubital nervures in forewing; 2 rows of discoidal cells .. ..*Lyriothemis cleis.*
Only 1 cubital nervure in forewing; 3 to 4 rows of discoidal cells.. 22

22. No markings on front of thorax; bases of all wings with two well-marked brown rays ..*Lyriothemis bivittata.*
Yellow antehumeral spots present on front of thorax; bases of wings unmarked or but poorly so .. ..*Lyriothemis tricolor.*

23. Outermost antenodal nervure in forewing complete 24
Outermost antenodal nervure in forewing incomplete 40

24. Posterior lobe of prothorax fringed with long hairs and very large 25
Posterior lobe of prothorax small or very small 37

Genus—*Acisoma* :—
25. Abdomen short, greatly inflated in its basal half, the apical part very slim and cylindrical; small species .. ..*Acisoma panorpoides.*
Abdomen variable 26

Genus—*Brachydiplax* :— ..
26. Forehead and thorax metallic coloured.. 27
Genus—*Orthetrum* :—
No metallic colouring 28

27. Forewing with 7 antenodal nervures; hindwing about 25 mm. in length .. .. ..*Brachydiplax sobrina.*
Forewing with 7 antenodal nervures; hindwing about 30 mm. in length .. .. ..*Brachydiplax gestroi.*
Forewing with 8-9 antenodal nervures; hindwing about 22 mm. in length .. .. ..*Brachydiplax farinosa.*

28.	Abdomen of male red; eighth nervure (Cuii) arising from posterior angle of trigone in hindwing	29
	Abdomen of male pruinescent blue; eighth nervure (Cuii) usually arising from posterior angle of trigone	30
	Abdomen of male black marked with yellow, the base tumid and the anal segments flattened and dilated dorso-ventrally; eighth nervure (Cuii) arising distad to the posterior angle of trigone in the hindwing	*Orthetrum sabina.*
29.	Abdomen of male red overlaid with a thin pruinescence giving it a violaceous tint ..	*Orthetrum pruinosum.*
	Abdomen of male bright red; lamina of genitalia with a tuft of stout hairs springing from it, easily seen in profile	*Orthetrum chrysis.*
	Abdomen of male bright red; lamina naked ..	*Orthetrum testaceum.*
30.	Eighth nervure arising distad to the posterior angle of trigone in the hindwing	*Orthetrum chrysostigma luzonicum.*
	Eighth nervure arising from the posterior angle of trigone in hindwing	31
31.	Sides of thorax pruinosed, the yellow markings showing through; abdomen palest blue, almost white	*Orthetrum japonicum internum.*
	Sides of thorax not pruinosed, or if so, then no markings visible, abdomen a darker blue	32
32.	Only 1 row of cells between *Rs* and *Rspl* ..	*Orthetrum anceps.*
	Two rows of cells between *Rs* and *Rspl*	33
33.	Smallest species of the genus with hindwing under 30 mm. in length; abdomen narrow and tapering 24 mm.	*Orthetrum tæniolatum.*
	Larger species with length of hindwing 36-38 mm, and of abdomen 29 mm, latter variable in shape, usually broad and depressed	34
34.	Trigone in hindwing entire	35
	Trigone in hindwing traversed by a nervure	36
35.	Abdomen long and narrow, entirely blue; hindwing with a small brown basal marking ..	*Orthetrum glaucum.*
	Abdomen short and broad, the three anal segments black; no marking to base of hindwing (Kashmir)	*Orthetrum cancellatum.*
36.	Abdomen blue with the end segments black; hindwing with a blackish brown marking	*Orthetrum triangulare.*
	Abdomen entirely blue; no marking basal to hindwing	*Orthetrum brunneum.*
	Genus—*Aethriamanta* :—	
37.	Subtrigone of forewing formed of only 1 cell..	*Æthriamanta brevipennis.*
	Subtrigone of forewing formed of 2 cells	38
38.	Only 6 antenodal nervures in forewing	39
	Genus—*Urothemis* :—	
	Seven antenodal nervures in forewing	*Urothemis signata signata.*
39.	Genus—*Selysiothemis* :—	
	Stigma white and black; neuration of wings whitish and almost invisible	*Selysiothemis nigra.*
	Genus—*Macrodiplax* :—	
	Stigma brown; neuration black and distinct ..	*Macrodiplax cora.*

40. Discoidal field commencing with a row of 3 cells and then continued for a short distance as rows of 2 cells 41
Discoidal field commencing with 2 or 3 cells and continued evenly as such 43

41. Genus—*Indothemis* :—
Lobe of prothorax small; abdomen black with or without yellow markings 42
Genus—*Rhodothemis* :—
Lobe of prothorax large; abdomen brilliant red. *Rhodothemis rufa.*

42. Only 6 antenodal nervures to forewing; apices of wings hyaline .. .. ..*Indothemis cœsia.*
13 antenodal nervures to forewing; apices of wings tipped with dark brown.. .. ..*Indothemis limbata.*

43. Genus—*Onychothemis* :—
Claws without any hooks 44
Claws with hooks 45

44. Ground colour of thorax deep black with a metallic lustre and bright yellow markings ..*Onychothemis tonkinensis tonkinensis.*
Ground colour of thorax coppery brown with a coppery lustre and bright yellow markings ..*Onychothemis culminicola culminicola.*

45. Apex of loop open.. 46
Apex of loop closed 47

46. Genus—*Zyxomma* :—
Abdomen very slim except at extreme base which is very tumid, pale olivaceous brown ..*Zyxomma petiolatum.*
Genus—*Tholymis* :—
Abdomen short and stout, red; hindwings with an opalescent white patch about the middle..*Tholymis tillarga.*

47. Lobe of prothorax very large, fringed with long hairs 48
Lobe of prothorax very small 54

48. Genus—*Diplacodes* :—
Discoidal field widely dilated at border of wing.. 49
Genus—*Sympetrum* :—
Discoidal field strongly contracted at border of wing 51

49. Apices of wings of male tipped with deep black.. *Diplacodes nebulosa.*
Apices of wings hyaline 50

50. Base of hindwing with a black marking ..*Diplacodes lefebvrei.*
Base of hindwing without marking .. ..*Diplacodes trivialis.*

51. Forewings with 6½ to 7½ antenodal nervures 52
Forewings with 8½ to 9½ antenodal nervures 53

52. Thorax dull red in front, greenish yellow laterally; abdomen bright scarlet .. .. *Sympetrum striolatum.*
Thorax red in front and laterally, with a bluish line in the middle of sides; abdomen bright scarlet .. ..*Sympetrum fonscolombei.*
Thorax black marked with bright yellow laterally .. ..*Sympetrum commixtum.*
Thorax sandy yellow .. ..*Sympetrum decoloratum.*

53. Thorax bright citron yellow laterally .. ..*Sympetrum hypomelas.*
Thorax dull red at the sides, smaller species ..*Sympetrum orientale.*

54. Genus—*Neurothemis*:—
Two or more cubital nervures in all wings; usually a great development of secondary neuration in the wings 55
Only 1 cubital nervure in all wings 57

55. Wings dark reddish brown with hyaline spaces at the apices .. ..*Neurothemis fulvia.*
Base of wings golden yellow to a little beyond the level of trigone .. ..*Neurothemis intermedia intermedia.*
Base of wings golden yellow nearly up to the stigma .. ..*Neurothemis intermedia degener.*
Wings golden brown (varying in intensity from light yellow to the darkest brown) as far as stigma, the border of the marking oblique inwardly in the hindwing .. .. ..*Neurothemis fluctuans.*
Wings as for the last (*fluctuans*) but the border of the brown marking in the wings running straight back to the posterior margin of the wing .. ..*Neurothemis terminata.*
Basal halves of wings deep black 56

56. Outward border of the black bordered with a white opalescent band .. ..*Neurothemis tullia tullia.*
The black not bordered with white .. ..*Neurothemis tullia feralis.*

57. Genus—*Zygonyx*:—
Very large species with the thorax metallic green, rest of body deep black marked with bright yellow .. ..*Zygonyx iris.*
Thorax non-metallic, or dully so and entirely without markings 58

58. Genus—*Rhyothemis*:—
Wings variegated with black and yellow or black without yellow, wings fragile, flight weak and fluttering like that of a butterfly 59
Wings not variegated with black and yellow save for an occasional small basal marking, wings robust; flight strong 62

59. Wings marked with black and golden yellow 60
Wings marked with black only 61
Wings brownish throughout with darker brown markings, small species .. .. ..*Rhyothemis obsolescens.*

60. Sexual differentiation very marked, the male with long narrow wings, female with short and broad wings .. ..*Rhyothemis variegata.*
Sexual differentiation not marked, very similar in colouring to the last:—a well marked black spot at the node of both wings, the apices black, a spot over trigone in forewing and also in both wings over *Rs* and *Rspl.* Two broad dark fasciæ at base of hindwing ..*Rhyothemis phyllis phyllis.*

61. Only 2 rows of cells between *Rs* and *Rspl*, wings entirely black with a metallic lustre (except the extreme apices) .. .. ..*Rhyothemis plutonia.*
Only 1 row of cells between *Rs* and *Rspl*, wings with only the basal halves black with a metallic lustre .. ..*Rhyothemis triangularis.*

62. Arc between antenodal nervures 2 and 3 63
Arc between antenodal nervures 1 and 2 64

63. Genus—*Potamarcha* :—
Two rows of cells between *Rs* and *Rspl*, abdomen black marked with yellow or entirely pruinosed dark blue in adults .. .. ..*Potamarcha obscura.*
Genus—*Lathrecista* :—
Only 1 row of cells between *Rs* and *Rspl*, abdomen crimson, the basal 2 segments black or pruinosed blue .. .. ..*Lathrecista asiatica.*

64. Discoidal field dilated 65
Discoidal field contracted or of even width throughout 67

65. Genus—*Bradinopyga* :—
Wings entirely hyaline; body mottled with black, grey and white; stigma black, white at both ends .. ..*Bradinopyga geminata.*
Genus—*Brachythemis* :—
Wings crossed medially by a broad orange band *Brachythemis contaminata.*
Genus—*Crocothemis* :—
Wings with a small basal golden yellow marking, abdomen crimson or reddish yellow 66

66. Abdomen crimson .. ..*Crocothemis servilia.*
Abdomen golden yellow .. ..*Crocothemis erythræa.*

67. Genus—*Trithemis* :—
Wings short, the hind moderately broad at base; discoidal field strongly contracted; abdomen variable; usually small species, rarely indulging in prolonged flight and never soaring 68
Wings long, the hind very broad at base; discoidal field contracted or of even width throughout; usually large robust insects indulging in long and soaring flight 70

68. Abdomen fusiform, rather broad and depressed, bright crimson .. ..*Trithemis aurora.*
Abdomen slim and cylindrical or triquetral 69

69. Thorax and abdomen bright vermilion red, base of wings crossed by a broad band of reddish yellow .. ..*Trithemis kirbyi.*
Thorax and abdomen black or dark violaceous from a thin coating of pruinescence ..*Trithemis festiva.*
Thorax golden brown; abdomen black marked with yellow; legs very long and slim; stigma bicolourous .. ..*Trithemis pallidinervis.*

70. Costal side of trigone in forewing shorter than half the inner side; no secondary close reticulation in hindwing 71

70. Genus—*Camacinia* :—
Costal side of trigone in forewing longer than half the inner side ; a very close reticulation at base of hindwings 75

71. Stigma in forewing much longer than that of hind 72
Genus—*Hydrobasileus* :—
Stigma in forewing very slightly longer than that of hind ; a basal marking of orange running along posterior border .. .. ..*Hydrobasileus croceus.*

72. Transverse ridges on abdominal segments 2 to 5 73
Genus—*Tramea* :—
Transverse ridges on abdominal segments 2 to 4 only; a dark opaque basal marking in hindwing 74
Genus—*Pantala* :—

73. Only 2 rows of cells between *Rs* and *Rspl* in both wings ; 3 rows of cells in discoidal field ..*Pantala flavescens.*
Genus—*Pseudotramea* :—
Three rows of cells between *Rs* and *Rspl,* in both wings. Four rows of cells in discoidal field ..*Pseudotramea prateri.*

74. Basal marking of hindwing golden yellow enclosing a dark reddish brown spot .. ..*Tramea basilaris burmeisteri.*
Basal marking in hindwing blackish brown without any surrounding zone of yellow ..*Tramea limbata.*

75. Three rows of cells between *Rs.* and *Rspl,* 5 to 8 rows of cells in discoidal field which is contracted .. ..*Camacinia gigantea.*
Only 1 row of cells between *Rs* and *Rspl,* 4 to 5 rows of cells in discoidal field which is dilated *Camacinia harterti.*

76. Genus—*Hemicordulia* :—
Trigone of hindwing in line with or a little proximal to the arc .. ..*Hemicordulia asiatica.*
Trigone of hindwing well distal of the arc 77

77. Genus—*Azuma* :—
Trigones and subtrigones traversed by one or more nervures 78
All trigones and subtrigones entire 80

78. Anterior half of wings at the base, as far out as the trigone blackish brown .. .. ..*Azuma vittigera.*
No marking at base of wings 79

79. Four large yellow spots and a yellow band on face .. ..*Azuma frontalis.*
A sinuous transverse yellow band on the face and a small spot near the eyes.. .. ..*Azuma vittata.*
A basal spot on epistome and six yellow spots on face .. ..*Azuma cyanocephala.*

80. Genus—*Macromia* :—
Discoidal field begins with 2 or more rows of cells, loop broad, at least 3 cells wide 81
Discoidal field begins with only a single row of cells ; loop only 2 cells wide 89

81. Comparatively small species with hindwing under 40 mm. in length and abdomen under 40 mm. 82
Larger species with hindwing over 40 mm. in length and abdomen over 45 mm. 84

82. Face pale yellow with black markings; abdomen black ringed with bright yellow .. ..*Macromia cingulata.*
Face black traversed by a median yellow stripe; abdomen black with paired spots of yellow which gradually decrease in size from the base to segment 6 83

83. Labrum without a yellow spot at its base; no yellow marking on segment 6 .. ..*Macromiaida.*
Labrum with a bright yellow basal spot and a pair of small yellow dorsal spots on segment 6. *Macromia flavocolorata.*

84. Front of thorax with a yellow humeral stripe 85
Front of thorax without a yellow humeral stripe 88

85. Abdominal segments 2 to 8 bearing broad diffuse yellow rings; face bright yellow marked with blackish brown .. .. ..*Macromia flavicincta.*
Markings on abdomen variable but never with broad yellow rings on all segments from 2 to 8. 86

86. Face brown, unmarked .. ..*Macromia ellisoni.*
Face black marked with yellow 87

87. Segment 10 all yellow; face black marked with yellow across the lower part of frons, this marking shaped like a pair of spectacles complete with its arms .. .. ..*Macromia binocellata.*
Segment 10 all black; face with a transverse line and four spots of yellow .. .. .. *Macromia atuberculata.*

88. Superior anal appendages yellowish; a broad yellow ring on abdominal segment 2, narrow and gradually decreasing on segments 3 to 6. *Macromia moorei.*
Superior anal appendages black; broad yellow rings on segments 2 and 3, narrow and gradually decreasing from 4 to 6 .. ..*Macromia indica.*
Superior anal appendages black; a broad yellow ring on segment 2, narrow on 3 to 5, none at all on segment 6 .. ..*Macromia trituberculata.*

89. Genus—*Idionyx*:—
Eighth abdominal segment not dilated in the female; arc between antenodal nervures 1 and 2 in the forewing or opposite the 2nd; vesicle and anal appendages variable 90
Genus—*Indomacromia*:—
Eighth abdominal segment dilated in the female; arc between the second and third antenodal nervures in the forewing; vesicle low and rounded; inferior anal appendage with a very long robust spine on either side of its middle, the apex notched .. ..*Indomacromia nilgiriensis.*

90. Superior anal appendages tapering, no spine beneath 91
Superior anal appendages broad and a little bifid at the end, a small spine beneath the middle third; inferior appendage with a long, robust spine on either side, the apex pointed. Female with the bases of wings bright golden yellow .. ..*Idionyx optata.*

91.	Vesicle in the female very high and conical	92
	Vesicle in the female very low and rounded	93
92.	Vesicle in the female resembling the horn of a rhinoceros, greatly lengthened and prominent; inferior anal appendage with a small spine on either side near the apex	*Idionyx corona nilgiriensis.*
	Vesicle similar to last but with its apex in front indented	*Idionyx corona corona.*
	Vesicle in female very high and conical but not strikingly prominent as in the last	*Idionyx ornata.*
93.	Humeral line present on front of thorax of female	*Idionyx nadganii.*
	Humeral line absent; inferior anal appendage without lateral spines	*Idionyx yolanda.*
94.	Subfamily—*Aeschninae* :—	
	Eyes broadly contiguous	165
	Eyes more or less widely separated or only just meeting	95
95.	Mid-lobe of labrum with a deep median fissure	96
	Subfamily—*Gomphinæ* :—	
	Mid-lobe of labrum entire	103
96.	Subfamily—*Cordulegasterinæ* :—	
	Median (basal) space without cross veins	97
	Subfamily—*Chlorogomphinæ* :—	
	Median space traversed	101
97.	Genus—*Cordulegaster* :—	
	Head transversly elongate; frons not as high as occiput; stigma short	98
	Genus—*Anotogaster* :—	
	Head globose; frons as high as occiput; stigma long	100
	Genus—*Allogaster* :—	
	Frons greatly developed, very high and almost as wide as eyes; stigma long	*Allogaster latifrons.*
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109.	Labrum not bordered with black; back of head black; lateral expansion of eighth abdominal segment marked with yellow	*Ictinus atrox.*
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114. Sides of thorax yellow, the sutures finely outlined in black; juxta-humeral stripe present in its upper part .. .. ..*Macrogomphus montanus.*
A broad black stripe on sides of thorax; juxta-humeral stripe absent; 9th abdominal segment unmarked .. .. ..*Macrogomphus robustus.*
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(*To be continued.*)

THE GIANT WOOD SPIDER (*NEPHILA MACULATA*).

By

CAPTAIN R. W. G. HINGSTON, I.M.S.

Continued from Page 923, *Vol. XXVIII.*

Part IV. AMOURS.

(*With a Plate and a text figure*).

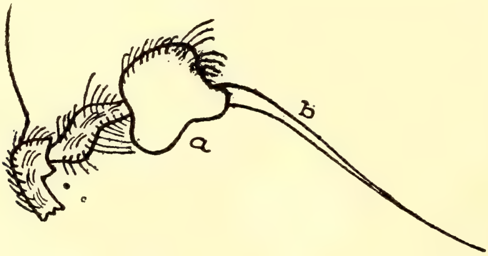
I come now to the last of the *Nephila's* lessons which is one associated with the reproductive act. It is the month of October. Throughout the rains the great spider has been busy at her work. Sheet after sheet of silk has been manufactured ; thousands of insects have been lured to the entanglement, and the spider, now gorged with the plenty of the season, begins to think about the reproduction of her kind.

If at this time we inspect the outskirts of the sheet, we are likely to observe near the upper margin a little spider of a yellow colour, in no way resembling the great *Nephila* and looking as though it were some humble stranger that had dared to invade the immense snare. It is only a pigmy compared with the giant, and, at first, I took it for a mere intruder, a kind of parasite on the greater host. I imagined that it was lying in ambush at the margin waiting for any stray fragments that might happen to come its way. This was no unreasonable supposition ; for here and there I see other invaders which have taken advantage of the *Nephila's* workmanship to spread their snares amidst her powerful lines.

But in this instance I was in error. The little pigmy was no wandering parasite. It had an amorous purpose to fulfil. Though it bore not the slightest resemblance to the architect, nevertheless it belonged to her own kind. It was the male who, at the call of the nuptial season, had arrived to pay addresses to his mate.

I have already described the great female herself. I will just remind the reader of her immense size ; she is one and a half inches in length and more than proportionate in bulk. I will ask him to recall those long slender limbs over six inches in span, that powerful head and ponderous body, and that profuse adornment, so elegantly applied, of orange-coloured spots and lines.

Now let us turn to the insignificant male. What a contrast does he not offer to his mate ! He is very plain in superficial appearance, and no more than one quarter of an inch in length. He shows no adornment, no strength, he



Palp of *Nephila maculata*, Male
a. *Globular dilatation.*
b. *Stilette.*

is an insignificant creature that no one would notice. While the female is the most magnificent example of her kind, the male is a dwarfed and miserable nonentity, appearing not one-hundredth part her size. As is usual, his head and thorax are fused into one piece. It is a pear-shaped mass with the point directed forward and is fairly densely clothed throughout in short and delicate hairs. Fixed to the apex of the elongated pear is the collection of six black eyes. They are but the minutest points, yet are quite conspicuous against the yellow background behind.

The palps project from the front of the head and deserve our special note. They are strangely modified into long stilettes which, as we shall later see, have a peculiar part to play in the reproductive act. Each is fashioned on the following plan. There is first a basal joint. It is slightly bent and somewhat club-shaped and is covered in delicate hairs. At its distal end are two additional small joints, and beyond these a globular dilatation in the form of a black sphere. These spherical enlargements of the two palps are prominent and conspicuous objects near the front of the spider's head. They too are clothed in a covering of hairs, and are, I suppose, modified joints. Now, from the surface of each of these black spheres there projects a straight and delicate stilette. It is almost as long as the rest of the palp, broad and slightly bent at the base but narrowing slowly and evenly to a fine attenuated point. It is devoid of any hairy covering and is the same black colour as the sphere. Thus we observe the strange modification of the palps into a pair of slender spears. They are directed backwards and a little outwards along the under surface of the chest. This is their natural position when at rest. Later we will see them in actual operation and will learn something of the extraordinary function which such organs are made to fulfil. Between the palps are situated the jaws. They are moderately strong and sufficiently serviceable, but insignificant when compared with the ponderous mandibles which the female requires for her work. Behind the thorax is hinged the abdomen shaped in the form of a cigar. It is long and narrow, fairly stout in front but graduating behind into a blunt and rounded point. In common with the greater part of the body it bears a coat of minute hairs. The legs also deserve a word of notice. Like those of the female they are long and slender and thus suitably adapted for progression in a snare. They are covered in a quantity of short thick hair and have in addition a singular armoury of long pointed scattered spines. This is the general structure of the male, different in almost every particular from his mate. Not even in colour is there the trace of a resemblance. The little male is almost a uniform yellow ; his tarsi are of a somewhat darker shade and on his abdomen are some brownish bands.

Let us take a note of his habits and behaviour. He usually takes his permanent station at the periphery of the female's snare. I generally see him at the upper margin, but sometimes he shows a greater enterprise by descending to explore the sides. He clings to the foundation lines with his spiny legs and occasionally makes a tentative advance into the main body of the snare. Like the female, he never becomes entangled in the architecture, and I see him, after her manner, covering himself with oil collected from his salivary glands. The life he lives is very peculiar. He is almost a parasite on his immense mate. He constructs no architecture of his own ; at least there is nothing of the kind apparent anywhere in the vicinity of his abode. His food is gained by chance and pillage. It is composed of the waste or neglected fragments for which the female has little use. It is not his business to weave and build ; he knows nothing of that marvellous geometrical skill. He comes into the world for one purpose alone, the fertilization of his powerful mate.

Except at the actual season of love there is no harmony between the two. He is in the nature of an unbidden guest. Indeed the female seems to regard him as an enemy and would drive him from the architecture if she could. But he has developed a ruse by which to escape, and the female, obviously aware of his skill, has learnt the futility of attack. She thus, of necessity, tolerates her partner and allows him a place at the edge of her snare. She realizes his presence; she feels the thrill along her radii every time he moves, but she knows the feel of her future partner and can immediately discriminate his peculiar tremor from that of a captured fly.

The strained relationship between the two is made manifest in his manner of obtaining food. Sometimes he falls on an occasional capture which chance has brought near the edge of the snare; at other times he finds an insignificant victim too small to attract the attention of his mate. These, however, are only windfalls, and are insufficient to supply his wants. He is often forced into a bolder action in that he attempts to rob the female of her prey.

Let us watch him for a moment in this act of pillage and witness how daring he is. The huge female has made a capture. She has transported it to the centre, sheathed it in silk, and has sucked out half its juice. She is engrossed in her gluttony and is gorging herself with food. This is the opportunity for the male. He is no doubt aware of the preoccupation of his partner, realizing that she is so engaged with her capture that she will neglect to drive him away. He becomes restless; then he leaves the margin and makes a hesitating advance into the snare. He moves with care and circumspection. At the slightest alarm he halts or hurries back to the outskirts again. Regaining courage, he once more moves in. The same careful advance follows, and, if the female makes no definite attack, he may reach the very centre of the snare. Now for a display of boldness which was more than I believed he possessed. He literally invades the female in her lair and attempts to snatch the victim from her jaws. He presses right in to the very centre; he works his way in between the female's legs; he insinuates himself between her great long belly and the sticky architecture of the snare. He then advances underneath her thorax, and I see him carefully stretch out a claw so as to try and pluck the insect from her jaws. He pulls, he jerks, but, since the female keeps a firm hold, his efforts for a time are without avail. He is very circumspect in this audacious operation and is all the time in readiness to make his escape. At length the female becomes a little restless as though she were beginning to get annoyed. Instantly he runs out along a radius and waits a short distance away. When everything is quiet he again creeps in, resumes his place beneath her belly and continues his efforts to rob her of the prize.

The male is, therefore, a plunderer of the female. He has very little power to capture his own food. I place an insect on the viscid lines a little distance away from a male. He approaches the struggling capture, but there is none of that swift and sudden rush with which the female dashes on her prey. He seizes it, but there is no crushing of the victim, nor any straight and deadly thrust direct into the vital point. He commences to feed, but we see none of that remarkable process by which the capture is ensheathed in silk. All these devices are absent in the male. He possesses no poison, no power to emit a skein of silk. Nor would they be of any value to him. He is accustomed to loot his partner's captures; they have been already poisoned and already encapsuled in silk. All the power that he requires is to suck out the body juice.

It is certainly a very remarkable sight to witness the audacity of this little spider, his extraordinary device for securing food and the strange relationship between two individuals which belong to one sexual pair. Mr. Belt, in his delightful *Naturalist in Nicaragua*, tells of a *Nephila* with social instincts in which a number of individuals linked their networks together so as to fashion a complete curtain of web. But here is the point of special interest. I will describe it in his own words. "Besides the large owner and manufacturer of each web who was stationed near its centre, there were on the outskirts several very small ones, belonging, I think, to two different species. I sometimes threw a fly into one of the webs. The large spider would seize it and commence sucking its blood. The small ones, attracted by the sight of the prey, would advance cautiously from the circumference, but generally stop short about half-way up the web, evidently afraid to come within reach of the owner; thus having to content themselves with looking at the provisions, like hungry urchins nosing the windows of an eating-house. Sometimes a more audacious one would advance closer, but the owner would, when it came within reach, quickly lift up one of its feet and strike at it, like a feeding horse kicking at another that came near its provender, and the intruder would have to retire discomfited. These little spiders probably feed on minute insects entangled in the web, too small for the consideration of the huge owner, to whom they may be of assistance in clearing it." Surely these small species at the outskirts of the web must have been the diminutive males. Their actions are so similar to what we have observed. There is the same place selected for their permanent habitation, the same cautious advance, the same fear of approach, the same show of resentment on the part of the owner and the hasty retreat out of harm's way. Mr. Belt was not witness to that final act by which alone the little mystery is solved.

It may be wondered why the female endures this inconvenience. Her mate clearly is but a burden to her. Why, therefore, does she tolerate his presence instead of driving him headlong out of the snare? She is certainly strong and powerful enough; the male lives in absolute dread of her and makes off if she attempts to approach. But he will not altogether abandon his position. He remains in hiding somewhere near the outskirts, ready to return when opportunity offers and all the time awaiting that propitious hour when he will be received with a better grace. Thus, though driven away a hundred times, he never fails to reappear. By his perseverance he will some day be accepted as a partner, the reward for all his pains. Until then the female can but keep him at a distance by forcing him to remain at the edge of the snare.

Why does she not seize him and crush him to pieces? Simply because he possesses a most ingenious method of escaping her terrible assault. He does not, of course, adhere to her snare; thus she cannot treat him in that off-hand manner which she deals out to her insect prey. The only means that she has of ejecting him is to chase him bodily from the sheet. She is fairly swift amidst her own lines and can easily effect this. Thus many a time she rushes towards him, but, swift as she is, she can never seize him, for he has learnt how to defeat her object in a very simple way. He has at his disposal an excellent ruse which he employs as a means of escape.

The plan is as follows. The male is advancing from the margin and is moving testily into the snare. Like all other spiders he pays out a line behind him and thus retains a slender attachment to the point from where he came. All of a sudden he is alarmed. The female is aware of his presence; she does not desire his advances now and will not permit his approach. She dashes towards him; her pace is swift and she is on the point of reaching him. But all of a sudden she comes to a halt and it is clear that her efforts have failed. The male has vanished; he is not even in the snare. In an instant he has been transported to the point from where he came, some two or three feet away. The female thus finds herself completely foiled, being unable to compete with such magic as this. She, therefore, climbs back again to the centre. Though she has succeeded in driving the male from her dominion, yet there can be little doubt that she hoped to destroy him. And at best the expulsion is only temporary, for he will soon think about invading her again.

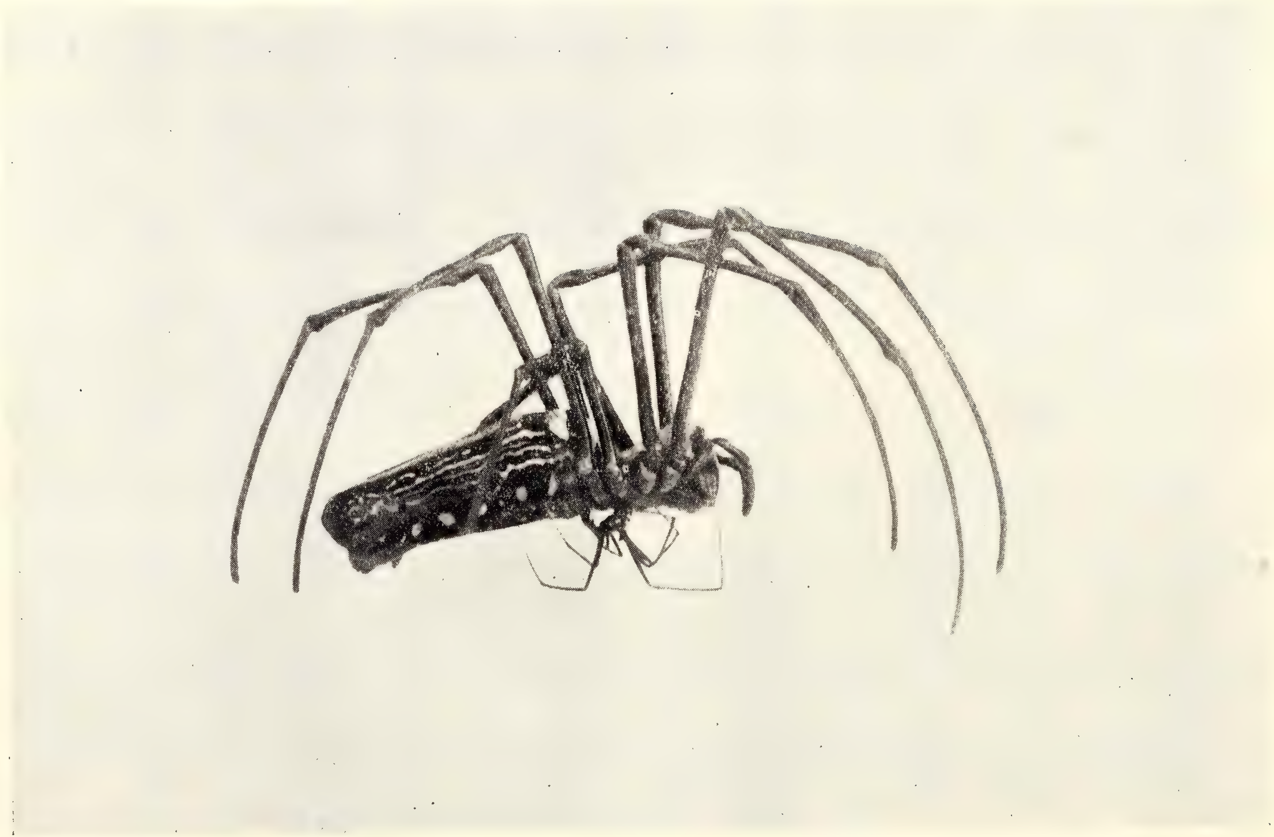
Let us consider what has occurred to account for this instantaneous escape. The female is dashing over her lines and is almost on the top of the male. But he does not rush hurriedly away and permit of an unequal pursuit. He has a better plan of escape than this. He merely lets go his hold on the architecture and by his own weight swings out into the air. In another moment he is up along his line and back at his old position at the edge. It is an extraordinarily expeditious act ; just one sudden swing, then one swift ascent, and he is clear of the danger below. Thus he foils the fury of his mate. She must keep to the meshes of her web while he swings himself abroad like a pendulum and then mounts through the invisible air. She is therefore compelled to tolerate the male because she cannot circumvent his skill.

If the sheet was fixed absolutely in the perpendicular, then this method of escape would fail. The spider could no longer swing like a pendulum, for his weight would not carry him away from the snare. But the sheet, though apparently perpendicular, is not exactly so. It is always constructed a little on a slant. Thus a line suspended from its upper margin will, if it hangs on the under surface of the slant, automatically swing away from the snare. Now the male has learnt how to conform his activities to this slight obliquity of the sheet. If he kept to the upper surface of the slant, then his skill would avail him nothing, since a swing would not carry him away from the snare. On the under surface, however, he would be perfectly secure. There he need only just release his hold and he will immediately swing away. Hence he confines himself to the under surface of the slant. Occasionally he may penetrate to the other side, but this is an unusual event. He keeps tenaciously to that aspect of the sheet which permits him to automatically swing out into the air.

We can now understand why the male establishes himself almost always at the upper margin of the snare. Though to our eyes all the edges appear alike, yet the male has a decided preference to be above. It is simply because from the upper margin he is able to effect this manner of escape. The manœuvre would be impossible from any other point. If he were to advance from one side or from below, and then, on encountering a swift attack, was suddenly to release his hold, he would, of course, free himself from the clutches of his mate, but consider at what a cost. If his anchorage was at the side, then he would probably have to drop some two or three feet ; if it were below, then the drop might be as much as five or six feet before the line of connection would feel his weight. There would be a quick fall, then a sudden jerk which would either cause a rupture of the thread or else tear it forcibly from the spinnerets. But by living at the upper margin of the snare the spider avoids the danger of this. The suspension line is continued vertically above him, and, as soon as he lets go his hold, the filament is immediately tense.

Day after day this hostility continues. The male is ever trying to pillage the female ; by stealth he is endeavouring to plunder her property, by skill to escape her jaws. Above all he is persistent in his determination to remain, and thus submits to the innumerable assaults. But at length there comes a time when the antipathy lessens. The female's hostility shows signs of weakening and she begins to admit the pigmy to her snare. The mating season is drawing near ; sexual enmities are fading from memory ; the female is preparing to accept her mate. He now casts off his air of hesitation and enters more boldly into the body of the sheet. Where before he was most detested, he is now most desired. He advances full of the air of conquest, realizing that the overpowering claims of sex have given him an entry to the widespread net.

The concourse is performed in a peculiar way. It occurs at that point of such prime importance, the very centre of the snare. There the female takes up her station, waiting passively in the hub of her dominions until the male thinks fit to advance. But she does not fix herself in the ordinary way with her ventral surface applied closely to the snare. She hooks herself by the legs of one side only and allows her opposite side to swing into the air. In this way she tilts her body away from her architecture, her object being to lay herself open so as to receive without obstruction the advances of her mate. He can now enter with her full approval, and need fear no impediment from the surface of the snare.



THE GIANT WOOD-SPIDER.
Male and female in conjunction.
(*Nephila maculata.*)

The male arrives. It is an extraordinary combination of different sexes; he is so diminutive compared with her. He first makes his way on to her back. There he strokes her with his spiny legs, the blandishments, I suppose, preliminary to the act. Having finished this, he winds himself round her immense flank and gets into position underneath. The sex act immediately takes place. Two of his legs are thrust forward on her thorax; the remainder hold her abdomen on either side. The usual physical contact follows. There is then a gentle heaving of the body, after which separation occurs. Now comes the extraordinary feature in the act. The concourse is completed with the organs of the mouth. It is difficult to see the details clearly, but it seems to happen like this. The male employs his pointed palps to direct the semen into the female's pore. Remember their peculiar modification into a pair of elongated stilettes. I see them raised from their place beneath the thorax, brought carefully to the female's aperture, and then delicately thrust within. There can be little doubt as to the nature of their action; they are being employed as a pair of directors to guide the fluid into the womb. They continue to act thus for a little while. Then they are withdrawn from the orifice of the female, and the more ordinary type of concourse is resumed. Again the palps come into operation; the same procedure is repeated after every contact so that it seems to be essential for the completion of the act. The whole performance is very remarkable and as strange a mode of sexual union as we could ever expect to see.

This continues at intervals for several days. The male is persistent in his amorous attentions. The female is the more passive partner and seems to take less interest in the act. Her passion at least is not sufficiently intense to withdraw her attention from her food. The male, now that he is at last accepted, refuses to leave the scene. When not engaged beneath the female, he returns to his original seat upon her back. This is his place of safety where he hastens on the slightest alarm. Touch the snare, and in an instant he is off. He has swerved around with remarkable rapidity and has fixed himself on the female's back. There he is secure from her great jaws, and, moreover, should she happen to move, he will not be crushed between her body and the snare.

How marvellously intense is that overwhelming impulse which demands the fulfilment of the sexual act. "Be fruitful, and multiply, and replenish the earth." This is the inexorable decree of Nature. And what persistence, what sacrifice, what prodigality of expenditure does she not often associate with her strict demand. And how careless is she of the hideous consequences that so often follow in her nuptial train. Sometimes of an evening I see the black ants emerge. There are scores of males in the voluptuous throng, yet their business is merely one act of fertilization after which comes a speedy death. The honey-bees maintain their swarms of drones, of which one alone in the vast multitude completes the vital purpose of his life. High in the heavens he establishes his suit when his entrails are mechanically torn from his body as he fetilizes the virgin queen. The nuptials of the mantis are equally tragic. There is a sudden rush, a prolonged acceptance, after which the male pays the awful tribute of being devoured by his more powerful mate.

Union is not happiness, pure and unalloyed. To every creature it brings its share of tribulation; to some it means a self-annihilation, a rendering up of the present existence to ensure the future of the race. For the *Nephila* it demands a dogged perseverance at the risk of life and limb. There is the ceaseless watch to escape the monster; the persistent occupation of the edge of the snare, the frequent repulse of undesired attentions, the unfailing return again and again. There are the schemes to pillage a morsel of the food, the clever escapes by the invisible swing and the ascent up the suspension line. There is the sacrifice of the power of inimitable workmanship, the reduction of the body to the pigmy state with the associated loss of individuality and strength. Nor must we forget those extraordinary palps, the appendages of the mouth which are fashioned into probes in order to direct the fluid in its course. Such are the most remarkable modifications of the male. His structure and character have been profoundly changed in order to attain the fulfilment of that act on which the future of the race depends. As the female discloses her incomparable workmanship in the architecture of her widespread sheet, so does the male display his tenacity of purpose in the fulfilment of the vital function of his life.

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY.

No. XXXVI.

On the Capped Langurs (Pithecus pileatus, Blyth, and its Allies).

By Martin A. C. Hinton.

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" *Semnopithecus pileatus* " was described by Blyth in 1842 (*J. A. S. B.*, XII, p. 17-4) from a half-grown female received by the Calcutta Museum from the Vice-regal menagerie at Barrackpore. Ignorant of the real provenance of this specimen, Blyth was at first inclined to identify it with Desmarest's " *Cercopithecus albocinereus* ", described from Sumatra. But in 1844 he received two specimens collected by the Reverend J. Barbe in the Chittagong Hills, together with the information from Mr. Skipwith (then Judge in Tipperah) that *pileatus* abounded in the skirts of the hills of Tipperah, retiring far into the interior during the rains, and it " would appear also to extend sparingly upon the Naga range eastward of Upper Assam " (*J. A. S. B.*, XIII, p. 467). Blyth in 1846 (*J. A. S. B.*, XVI, p. 735) received an adult male collected by Skipwith in Tipperah, and from that time forward he expressed no doubt as to the habitat of the species. Thus in his " Catalogue " of 1861 (p.12) he gave the habitat of *pileatus* as " Nagas, and hill ranges of Sylhet, Tipperah, Chittagong."

Mr. H. W. Wells and Mr. J. P. Mills have lately made most valuable collections in Assam for the Society's Mammal Survey. These includes a fine series of Capped Langurs, illustrating the geographical variation of *P. pileatus* in the country to the south of the Brahmaputra, between the Garo Hills on the west and the Nagas with the district of Lakhimpur on the east. In addition Mr. Wells obtained a number of specimens, also referable to this species, from the northern side of the valley of the Brahmaputra, in Northern Kamrup. Death having deprived us of the invaluable assistance of Mr. Wroughton, the duty of working out this portion of the collections from Assam devolved upon me, the results of my studies may be briefly stated as follows.

In the first place while all the specimens collected by Mr. Wells and by Mr. Mills in Assam are referable to *P. pileatus*, this species does not appear to have been represented previously in the National Collection. The form believed to have come from Cachar or from Lower Assam, which Wroughton identified (*J. B. N. H. S.*, 25, p. 557) with *pileatus* appears now to be distinct ; and the name " *durga*," which Wroughton (in mistake) first applied to it (*op. cit.*, 24, p. 564), becomes valid.

With regard to *pileatus* proper, the Survey material shows that there are three well marked geographical races or subspecies. Firstly, a pallid form, which agrees very well with the descriptions of the type given by Blyth and Anderson, and which may therefore be regarded as the typical subspecies *P. p. pileatus*. This inhabits the Garo and Khasi Hills, whence we have specimens from localities situated at levels between 1,400′ and 2,000′ ; but it also ranges far to the east into the Naga Hills, where however, it is, as I am informed by Mr. Mills, a purely highland animal, not mixing with the next form to be noticed, but living alone in the cool jungle met with at heights of from 4,000′ to 5,000′. On the floor of the valley of the Brahmaputra in the Lakhimpur district occurs a form, characterized by a much richer and more normal coloration ; this is described below as a new subspecies *P. p. saturatus*, the range of which extends southwards for some distance up the lower slopes of the Naga Hills. Lastly the subspecies living on the opposite bank of the Brahmaputra in Northern Kamrup is distinguished by its exceptionally dusky coloration, especially noticeable upon the rump and thighs, and this is described below as *P. p. tenebricus.*

All these subspecies of *pileatus* are animals in which the light-coloured underparts and the flanks are sharply and strongly contrasted with the darker dorsum. In *P. p. pileatus* and *p. saturatus* the dark dorsal area is relatively narrow, so that the bright flanks are very conspicuous features in the dorsal view of the animal. The skulls do not appear to afford any character by which the subspecies can be distinguished either from each other or, apart from the size of the teeth, from the forms next to be noticed. The cheek-teeth in all three races of *pileatus* are small, the upper tooth-row (canine to *m.* 3) measuring 33·5 to 37·5 mm., while the length of the three molars ranges between 18·2 and 20 mm.

The three remaining species of the group, *viz.*, *P. shortridgei*, Wr., (Upper Chindwin), *P. durga*, Wr., (Cachar or Lower Assam), and *P. brahma*, Wr., (Lakhimpur), have the colour and pattern duller and much less conspicuous than in *pileatus.* In *P. brahma* the teeth are small as in *pileatus*, but in *durga* and *shortridgei* they are distinctly though slightly larger (canine to *m.* 3, 37 to 38·5 mm., *m.* 1 to *m.* 3, 20·5 to 21·5 mm.).

The following is a " key " to the six members of the *pileatus* group recognized in this paper :—

A. Colour pattern bright and conspicuous. Under parts (including the upper flanks) well-haired, and always strongly contrasted with the dark mid-dorsum. Tail with its proximal half concolorous with the back, its distal half black. Teeth small (Canine to *m.* 3, 33·5–37·5mm ; *m.* I–3, 18·2–20mm).

  a. Dark mid-dorsal area narrow, the bright flanks conspicuous in the dorsal view. Rump and outer surfaces of thighs not dusky.

    a. General colour of back neutral grey, paling to smoke grey on rump. Whiskers pale ochraceous. Flanks and inner surfaces of limbs white. Ventral surface ochraceous.

      P. pileatus pileatus, Blyth.

      (Garo Hills, east to Nagas).

b. General colour of back dusky brown, the rump darker than in *a.* Whiskers, flanks, under parts bright orange.
P. p. saturatus, subsp. n.
(Lakhimpur and lower slopes of Nagas).

b. Dark mid-dorsal area not contrasted, the bright flanks scarcely or not visible in the dorsal view. Rump and outer surfaces of thighs blackish, like the head and back. Whiskers, flanks, and under parts intensely ochraceous.
P. p. tenebricus, subsp. n.
(North Kamrup).

B. Colour pattern dull and inconspicuous., the upper flanks concolorous with the back. Under parts less strikingly, or not at all, contrasted often thinly haired. Tail with not more than the proximal third concolorous with back, its distal two thirds black.

a. Teeth large (upper canine to *m.* 3, 37–38·5 mm ; *m.* 1 to *m.* 3 , 20·5–21·5 mm.)

a. General colour cinerous. Whiskers only slightly paler than the general body colour. Under surface coloured like the back.
P. shortridgei, Wr.
(Upper Chindwin).

b. General colour dusky brown ; Whiskers and under surface ochraceous.
P. durga, Wr.
(Lower Assam).

b. Teeth small (upper canine to *m.* 3, 35·5mm ; *m.* I to *m.* 3,19·7mm.). General colour cinerous ; whiskers pure white ; under surface greyish on chest, buff on the abdomen.
P. brahma, Wr.
(Lakhimpur, Upper Assam.)

With regard to the status of these six forms there can be no doubt that all are very closely related to each other ; and when the ranges of *durga* and *brahma* become better known it may be possible to treat them all as subspecies of one widely ranging species *P. pileatus.*

P. argentatus, Horsfield, remains to be noticed. The type of this nominal species, as traced by Wroughton, is a specimen now in the British Museum (No. 79.11.21. 597) obtained from Sylhet. Wroughton treats the name *argentatus* as a synonym of " *pileatus*", that is to say of the form called *durga* in this paper ; and could this identification be supported, the name *argentatus* would, by the law of priority, have to replace the much later name *durga.* But the type of *argentatus* is a young specimen and in my opinion not determinable with precision ; all that can be said of it is that it is a member of the *pileatus* group.

I. *Pithecus pileatus pileatus,* Blyth.

Garo Hills.—Tura (1,400′), ♂ 282, adult, and three flat skins.

Khasi Hills.—Laitkynsao (2000′), ♂ 521, juv.

Jaintia Hills.—Ranang (4,800′), ♂ ad. 918 Konshong (3,000′), ♂ juv. 855 ; ♀ juv., 861.

Naga Hills.—Mokokchung (5,000′), ♂ and ♀ ; Cholimsen (4000′), —

General colour of dorsal surface neutral grey, darkest on top of head, where it is almost black, gradually paling towards the rump where it becomes smoke-grey. Whiskers pale ochraceous, white posteriorly. Flanks whitish above, in strong contrast with the narrow dark dorsal area, and conspicuous in the dorsal view of the animal ; the flank colour becomes yellower below, to merge insensibly in the general ochraceous tint of the ventral surface. Outer surfaces of the arms pale smoky grey ; their inner surfaces cream-coloured. Legs with the outer surfaces of thighs neutral grey, concolorous with the middle of the back, the tint gradually lightening downwards to become white between the knee and the ankle ; inner surfaces white. Upper surfaces of hands and feet light grey, darkening distally ; the digits dusky. Tail gradually darkening distally ; in its proximal half not darker than the mid-dorsum ; its terminals half black.

Type.—A half-grown female in the Calcutta Museum (No. 31d. of Blyth's Catalogue, 14d. of Anderson's Catalogue), received from the Barrackpore Menagerie. Of the material before me, I have taken the adult male No. 282 obtained by Mr. Wells at Tura in the Garo Hills as being a typical specimen.

Remarks.—The more important statements made by Blyth with regard to his type are :—" general colour a delicate soft-grey, rather darker on the upper part of the back, and slightly inclining to albescent on the arm, forearm, and leg " ; " sides of the crown blackish " ; " hair of cheeks whitish and strongly contrasted being considerably lengthened laterally and posteriorly, so as to hide the lower part of the ear, behind which there is also some similar long and glistening whitish hair continued from beneath " ; " whole of lower parts and inside of the limbs dull fulvous white." Anderson describes the same specimen as being " light coloured ; under parts pale-yellow ; no trace of orange. General colour of upper parts and outside of limbs greyish or fuliginous, darkest on the front of the head and on the shoulders." These details apply so exactly to the subspecies inhabiting the Garo Hills that I have no hesitation in identifying it with the animal originally described by Blyth.

The young male from Konshong (Wells, No. 855) is very interesting. The terminal third of the tail is ochraceous instead of black as in the adults, while the proximal part is grey like the back. Possibly an ochraceous tail-tip is a normal feature of the juvenal pelage, the tail becoming black distally only in later coats.

Specimens obtained by Mr. Mills in the Naga Hills show that this subspecies ranges far to the eastwards, the lower limit of the altitude at which it occurs increasing in that direction. Mr. Mills informs me that in the Nagas this form is only found in the high cool jungle occurring above 4000′. The subspecies next described *P. p. saturatus*, is found on the floor of the valley and at lower levels on the flanks of the hills. It and true *pileatus* are never found together ; and no individuals of an intermediate character or appearance have been seen.

2. *Pithecus pileatus saturatus*, subsp. n.

Lakhimpur.—Bara Hapjan (200′), ♂ 30, ad., 31.
Sebsagar.—Golaghat (300′), ♂ 234, ♀ 161, 162.
Naga Hills.—Lakhuni (1,500′), ♂.
N. Cachar.—Lanka (400′), ♂ 1,031. Lamsakhang (800′), ♂ and ♀.

This subspecies differs from *P. p. pileatus*, as above defined, in having the whiskers and under parts deep orange, instead of white on pale ochraceous.

General dorsal colour dusky brown ; the rump decidedly darker and browner than in *p. pileatus*. Whiskers, flanks and under parts bright reddish orange ; none of the hairs white or whitish in adults. Outer surfaces of limbs dark brown ; on the leg the part between the knee and the ankle scarcely paler than the outer surface of the thigh ; inner surfaces of limbs deep ochraceous. Hands and feet blackish from wrists and ankles. Tail with the proximal half like the back ; its distal half black.

Type.—Adult male, B. M. No. 21,7.13 5. Original No. 30. Collected at Bara Hapjan, Lakimpur, Upper Assam, on November 2nd, 1919, by Mr. H. W. Wells. Presented to the British Museum by the Bombay Natural History Society. For measurements see tables at pp. 82–83.

Remarks.—Although technically the pale coloured animal inhabiting the Garo Hills and the higher parts of the Nagas is the typical subspecies, the present form represents a phase of more normal colour.

P. p. saturatus is the subspecies met with in the valley of the Brahmaputra, upon the low ground between the river and the Naga Hills ; it ascends the slopes of those hills for some distance, but does not reach the cool jungles, at high altitudes, inhabited by *P. p. pileatus.* The exact limits of the range of *saturatus* are unknown, and may be far more extensive than the specimens before me would indicate, for those described by Blyth and later by Anderson from the hills of Tipperah and Chittagong seem, from the descriptions published, to be very similar to those upon which *saturatus* is based.

3. *Pithecus pileatus tenebricus*, subsp. n.

North Kamrup.—Matunga River, ♂ 1296, ad.
Menaka Nadi (500′), ♂ 1363 ad.
Bogra Nadi (2,000-3,000′), ♂ 1352, juv., ♀ 1311, 1312, ad.

Characterized by its dark coloration, inconspicuous flanks and dusky limbs.

General colour of upper parts dusky ; the head cap black, paling gradually backwards into a blackish or very dark grey upon the rump. Some of the hairs, especially upon the nape, with light-coloured or silvery tips. Dark dorsal area not narrow ; the bright flanks scarcely visible in the dorsal view. Dorsal margins of whiskers and flanks pale ochraceous posteriorly, becoming redder ventrally. Under parts generally ferruginous as in *p. saturatus* but the tint not so intense as in the latter. Outer surfaces of arms and legs dusky ; thighs and legs between knees and ankles concolorous with each other, and with the rump and lower back. Hands and feet black above ; the feet more or less grizzled with whitish hairs. Proximal half of tail blackish grey, its distal half jet black.

Type.—Adult male, B. M. No. 21.7.13.8, Original No. 1296.

Collected by Mr. H. W. Wells at Matunga River, North Kamrup, December 31st, 1920. Presented to the British Museum by the Bombay Natural History Society. For measurements see tables at pp. 82–83.

Habitat.—Northern Kamrup.

4. *Pithecus durga,* Wr.
5. *Pithecus shortridgei,* Wr.
6. *Pithecus brahma,* Wr.

With regard to these species it is not necessary for me to add anything to the descriptions published by Wroughton in this Journal in 1916 (Vol. XXIV., p. 653), nor to the remarks made in opening the present paper.

The following are the measurements of the various members of the *pileatus* group now before me.

External measurements of *Pithecus pileatus* in millimetres. (Taken in the flesh by the Collector, Mr. H. W. Wells).

———	Head & body.	Tail.	Hind-foot.	Ear.	Weight.
Pithecus pileatus pileatus.					
GARO HILLS: Tura, ♂ ad. No. 282	700	1,025	190	34	
JAINTA HILLS : Ranang, ♀ ad. No. 918	570	870	185	30	21·5 lbs.
KONSHONG ♂ juv. No. 855	310	435	110	28	5·2
,, ♀ ,, ,, 861	310	580	130	28	
Pithecus pileatus saturatus.					
LAKHIMPUR : Bara Hapjan, ♂ ad. No. 30.. ..	685	978	193	33	(TYPE)
SEBSAGAR : Golaghat, ♂ ad. No. 234	583	990	197	30	
Golaghat, ♀ ad, No. 161.	500	830	180	30	
NORTH CACHAR : Lanka, ♂ ad. No. 1031	580	1,020	230	36	27 lbs.
Lamsakhang, ♀ ad. No. 1010.	490	840	160	26	
Pithecus pileatas tenebricus.					
NORTH KAMRUP : Matunga					19·5
River. ♂ ad. (TYPE)	560	910	180	40	
No. 1296	520	895	182	40	
Menaki Nadi. ♂ ad. No. 1363					
Bogra Nadi, ♀ ad. No. 1311.	450	710	160	40	
♀ ad. ,, 1299.	560	850	175	40	

Skull measurements of *Pithecus pileatus* and allies (Millimetres).

Adult Males.	Extreme length.	Condylo-Basilar length.	Zygomatic breadth.	Cranial breadth.	Post orbital breadth.	Greatest width across orbits.	Width of palate across *m*2-*m*2.	Canine to *m*3.	*m*1 to *m*3.
P. p. pileatus.									
Garo Hills, No. 282	115·5	85	88·3	64	49	69	37	35·5	19·6
Naga Hills, No. 4	119	87	..	67	51	75	38·5	37·5	20
P. p. saturatus.									
Lakhimpur, No. 30 (Type)	116·5	87·5	87·5	64·5	52·5	76	40	33·5	18·2
N. Cachar, No. 1031	120	90	86	64	49·5	72	38	36·5	20
P. p. tenebricus.									
N. Kumrup, No. 1296 (Type)	104·5	76	81	65	45·5	67	35	34·5	19·5
P. brahma.									
Lakhimpur, B. M. 13.2.21.1 (Type) ..	109	80·5	81	62	51	68	40	35·5	19·7
P. durga.									
" Lower Assam ", B. M. 86.10.18.1 (Type)	116·5	88	86	64·5	50	73	40	37·5	21·5
P. shortridgei.									
Chindwin, B. M. 15.5.5.10 (Type) ..	114	87	90·5	63	50	78	39·5	38·5	21·5
15.5.5.14	114	84·5	92	62·5	51	75	39·5	37	20·5
M. S. 5849	110	82	85	64	54	77·5	38	38	21

No. XXXVII.

ON TREE-SHREWS FROM THE MERGUI ARCHIPELAGO.

BY

OLDFIELD THOMAS, F.R.S.

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The Bombay Natural History Society has received from Mr. Primrose a number of Tree-Shrews from the Mergui Archipelago collected by him in 1921. They are from the various islands from Tavoy to Sullivan's Island, opposite to the districts on the mainland where occur *T. belangeri tenaster* and *T. clarissa*, described by me in the Journal for 1917.

Those from the southern Islands, Sullivan's and Hastings Islands, and, more doubtfully, Kissaraing, appear to be referable to the mainland form opposite them, *T. clarissa.*

But the northern ones, from Tavoy, King's and Ross Islands, are decidedly darker than the mainland *tenaster,* a darkening which is at its maximum in King's Island, and this would seem to necessitate the giving of a special name :—

Tupaia belangeri brunetta, subsp. n.

Essentially similar to *T. b. tenaster,* but (at least in the later part of the year darker in colour, with a specially darker crown, which is in some cases almost black. Posterior part of back, in representative specimens, with a broad blackish wash, which is, however, not present in all, but is probably seasonal.

Dimensions of type :—Head and body 179 mm.; tail 150 ; hindfoot 42 ; ear 19. Skull, greatest length 50 mm.; length of snout 23.

Hab.—Northern islands of Mergui Archipelago ; type from King's Island.

Type.—Adult male. B.M. No. 23. 1. 6. 35. Original number 77. Collected 1st October 1921 by Mr. C. Primrose. Presented to the National Museum by the Bombay Natural History Society.

Even then it is not certain that the black back appears in October in the Tavoy and Ross specimens, as none of suitable date are available, but they may be provisionally assigned to the same form as those of King's Island. Those of all three islands are distinguished from *tenaster* by the noticeably darker crown. The light shoulder mark is strongly developed in all the northern Mergui specimens, much more so than in the southern.

No. XXXVIII.

THE MOUSE-DEER (TRAGULUS) OF THE MERGUI ARCHIPELAGO.

BY

OLDFIELD THOMAS, F.R.S.

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Mr. Primrose has obtained in the Mergui Archipelago a number of specimens of the genus *Tragulus,* all belonging to the group of smaller species—the *kanchil* group.

From Lampi or Sullivans' Island, in the southern part of the Archipelago he has sent examples topotypical of Miller's *Tragulus lampensis*, or, as I should prefer to call it, *T. ravus lampensis*, thus attaching it to its parent form, the *T. ravus* of the peninsular mainland. It is a form in which the buffy or ochraceous tints are at a maximum, and the back is scarcely blackened at all.

But from Kisseraing, half-way up the Archipelago, and King's Island, in its northern part, the *Traguli* are so much darker than either *lampensis* or the mainland *ravus* as to deserve subspecific distinction.

Tragulus ravus mergatus, subsp. n.

Colour essentially as in *ravus*, but the back more heavily blackened and with the dorsal dark colour passing down on the sides of the neck, shoulders and flanks, while in *ravus* these latter are very markedly lighter than the back. Under surface with the ochraceous markings at a maximum as regards extent and richness of tone, but they are, as usual, very variable; in the type the whole middle area of the belly is rich ochraceous, the white of the chest and inguinal regions completely separated.

Dimensions of the type.—Head and body 480 mm.; hindfoot 186. Skull, greatest length 103.

Hab.—Northern half of Mergui Archipelago; type from King's Island, other specimens from Kisseraing.

Type.—Adult female B. M. No. 23.1.6.73 Original number 97. Collected 6th October 1921 by Mr. C. Primrose. Presented to the National Museum by the Bombay Natural History Society. Three specimens from King's Island and three from Kisseraing.

It may be noted that the Kisseraing specimens were killed in the comparatively dry month of January, while the paler *lampensis* of Sullivans' Island were killed in March, so that the darker colour of the former does not seem to be due to seasonal "saturation".

No. XXXIX.

ON THE LARGE SQUIRRELS OF THE RATUFA GIGANTEA GROUP.

BY

OLDFIELD THOMAS, F.R.S.

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While naming specimens of *Ratufa* from the Mergui Archipelago I have had occasion to look through all our material of the *R. gigantea* group in order to learn the relationships of the different forms to each other.

Mr. Miller has separated the mainland members of the group into two—the northern *gigantea*, and the more southern *phœopepla* which runs from Tenasserim down into the Malay Peninsula, with various insular forms in the islands. As usual he applies binomial terms to insular forms, and on this account uses *phœopepla* as the primary specific name for the Tenasserim animal, the earlier *melanopepla* having been founded on the form of Telibon Island. But, as in other cases, I am not prepared to use binomial terms for every island race, and should certainly consider *melanopepla* specifically inseparable from the mainland forms, so that this name would be equally applicable to the animal of Tenasserim, which should, therefore, bear the trinomial *R. melanopepla phœopepla.*

Now *R. melanopepla* in the broad sense—that is, including all the forms from Tenasserim southwards—is characterised not only by its untufted ears, but by having a broad wash of yellow crossing the black of the upper side of the forearm and wrist, and it is interesting to trace how far north this coloration is found. It occurs in Southern Siam, but at Chieng-mai we find the black-wristed form, which is therefore to be reckoned as belonging to *R. gigantea,* and not to *melanopepla.* More to the west, the *melanopepla* wrist-colour occurs in the Mt. Popa *marana* and the Lower Chindwin *felli,* the latter being the most northern known. But these two animals, *marana* and *felli,* have, in addition, a corresponding extension of the yellow on the hind limb, forming a small patch on the inner side of the metatarsus (*outer* in the prepared skins with the feet reversed) this double marking also occurring in several of the races of *melanopepla,*much further south.

But in *gigantea,* which has no forearm patch, the distribution of the metatarsal patch proves to be of interest in regard to the races of that animal. We find no trace of it in Nepal, Sikkim (presumably Bhotan), and Mishmi specimens, representing the rather doubtful subspecies *R. g. macruroides* Hodgs. In Assam, where the typical *gigantea** occurs, a few and almost imperceptible yellow hairs are to be found in some specimens, but not in all. Further eastwards and southwards the yellow increases in amount, until after passing a zone (from the Naga Hills to near Mandalay) where it is irregular or occasionally absent, the Squirrels from Myitkina, Katha, Shan States and North Siam always appear to have it present and well defined.

This being the case, we should apparently recognise the latter as forming a yellow-marked subspecies grading north-westwards into *gigantea,* but abruptly and sharply separated on the south from the *melanopepla* forms without any yellow on the hind foot, but with prominent patches on the fore.

Ratufa gigantea stigmosa, subsp. n.

Essentially like true *gigantea* so far as the tufted ears, and the absence of a forearm patch are concerned, but with a well-marked yellow patch on the hallucal side of the metatarsus. Size about as in *gigantea,* though the two Siamese specimens (one the type) have the skull a little larger than is usual in that animal.

Dimensions of the type, measured in the flesh :—Head and body 417 mm ; tail 477 ; hindfoot 82 ; ear 30. Skull, greatest length (to occipital crest) 79 ; condylo-incisive length 72·5 ; zygomatic breadth 48·2 ; upper tooth-series 15.

Hab.—North-Eastern and Eastern Burma and North Siam. Type from Doi Sritepe, Chiengmai, Siam. Other specimens from Myitkina (Venning, Madaya (Barton), Gokteik (Shortridge), Katha (Kemmis) and Melamoung W. Siam (Stockley).

Type.—Adult female. B.M. No. 98. 10. 5. 40. Collected 10th April 1898 and presented by Mr. Th. H. Lyle.

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*Messrs. Robinson and Kloss speak of the type specimen of *gigantea* as "formerly in the Indian Museum, but apparently no longer in existence." It was however still in the Indian Museum when that was broken up, and is now in the British Museum—B.M. No. 79 11. 21. 336.

Owing to having had something like sixty years exposure to light, this type is completely bleached, and has become so like *R. g. lutrina* of the Chindwin as to be almost indistinguishable from it. But McCleveand described the animal as being glossy black, so that he certainly did not (and indeed could not at that date) get *lutrina* from the Chindwin. The *R. gigantea* black is known to bleach to brown as may be seen on the old fur of many changing specimens, and there is no doubt the same change has taken place, *post mortem,* during the long period of exposure we know this specimen to have had.

No. XL.

A NEW MOUSE FROM MADURA, S. INDIA.

BY

OLDFIELD THOMAS, F.R.S.

(Published by permission of the Trustees of the British Museum.)

Among some specimens from the Palni Hills region of Madura, collected for the Mammal Survey by Mr. C. McCann, and submitted to me by the Bombay Natural History Society there occur some examples of a *Leggada* which has a really remarkable resemblance to the *L. cooki*, Ryley, of the Shan States and Chin Hills, no mice allied to the latter being known from any of the great intervening area. A close comparison of the two, however, shows that the S. Indian form has decidedly shorter ears, and there are also other slight differences, so that a special name is clearly required for it.

Leggada palnica, sp. n.

General appearance as in *L. cooki*. Size averaging slightly less. Fur not spinous in any of the specimens, while it often is in *cooki;* hairs of back about 7 mm. in length. General colour above dull mouse-brown, with scarcely any trace of the warmer and more rufous tint found in *cooki*. Undersurface dull whitish, sometimes washed with drabby, the bases of the hairs broadly slaty. Ears decidedly shorter than in *cooki*, measured as 13 mm. in most of the specimens, 14 in two, while in a series of *cooki* this measurement is usually 16, sometimes 17 and rarely 15 mm. ; in some spirit specimens of *palnica* the ears attain at most 14 mm. Hands and feet white. Tail short-haired, blackish above, whitish below, the contrast not strongly marked. Mammae 3-2-10.

Skull very like that of *L. cooki*, but slightly smaller and more slenderly built. Palatal foramina reaching to the level of the anterior third of m^1. Molars of normal proportions, m^1. not specially elongated.

Dimensions of the type, measured in the flesh :—Head and body 78 mm. ; tail 90; hindfoot 17; ear 13. Skull, greatest length 23; condylo-incisive length 21·7; nasals 8; interorbital breadth 3·3; breadth of brain case 10·3 ; palatal foramina 5·5; upper molar series 3·7.

Hab.—Palni Hills, Madura, S. India. Type from Shambagama, 6,000 ; other specimens from Perumal, 5,000′, Kodaikanal, 7,000′; and Silver Cascade, 5,800′.

Type.—Adult male B.M. No. 23.1.8.5 Original number 26. Collected 22nd February 1922 by Mr. C. McCann. Presented to the National Museum by the Bombay Natural History Society. Fifteen specimens examined.

The mice of this part of S. India hitherto obtained are all either members of *Leggadilla* or of the very different *Leggada booduga* group. Mr. McCann obtained examples of both of these as well as of the new form.

No. XLI.

ON THE FORMS CONTAINED IN THE GENUS *HARPIOCEPHALUS.*

By

Oldfield Thomas, F.R.S.

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Among the small mammals obtained for the Survey by Mr. McCann in the Palni Hills, S. India, there occurs a specimen of *Harpiocephalus*, a genus scarcely known from the peninsula of India, and I have, therefore, made a careful comparison of this specimen with our other examples of the group.

The only species of restricted *Harpiocephalus* hitherto known is the original *H. harpia* of Java, with what I should consider a recognisable subspecies in Darjeeling and Bhotan, *H. h. lasyurus*, Hodgs.

To these the S. Indian animal, of which a second specimen, from Malabar, is in the British Museum, is very nearly allied, but it would seem to be subspecifically separable, having a longer forearm than either the Himalayan or Javan forms, while it is of the bright colour of the latter. It may be called

Harpiocephalus harpia madrassius, subsp. n.

Forearm longer than in the other subspecies, two females having theirs 53·5 and 52 mm., as against 49·5, 50·0 and 50·5 in Javan females, the males of the latter being again smaller. Of the Himalayan *lasyurus* a male has the forearm 45·5, and another specimen, probably a female, 50·7.

Colour bright rufous, as in *harpia*, the grey woolly underfur contrasting with the red of the tips of the hairs. In *lasyurus* the ground colour is much browner.

Dimensions of the type :—Forearm 53·5 mm. ; head and body, measured in flesh, 66 ; tail 49 ; ear 17 : third finger, metacarpus 51 ; first phalanx 22 ; lower leg and hindfoot (c.u.) 34.

Hab.—South India. Type from Perumal, Palni Hills, 5,000′ ; another specimen from Malabar.

Type.—Adult female, skin without skull. B.M.No. 23.1.8.1 Original number 83. Collected 29th March 1922 by Mr. C. McCann and presented by the Bombay Natural History Society.

Besides the examples of the three races of *H. harpia, harpia, lasyurus* and *madrassius,* there are in the Museum two spirit specimens of a very fine *Harpiocephalus* from Upper Burma, which is clearly a different species, and may be called

Harpiocephalus mordax, sp. n.

Size larger than in *harpia.* Colour corresponding to that of the brightest rufous examples of that species.

Skull markedly larger than that of *harpia,* with bigger crests and more widely expanded zygomata. Muzzle much developed, broad and heavy. Anterior teeth, incisors and canines, much enlarged, very stout and heavy, while even the premolars are slightly broader than the first molar, than which they are narrower in *harpia.* Posterior molar not quite so minute as it is in the latter.

Dimensions of the type, measured on the spirit specimen :—Forearm 54 mm. ; head and body (contracted) 61 ; tail 46 ; ear 19 ; third finger, metacarpus 50 ; first phalanx 23·5 ; lower leg and hindfoot (c.u.) 35. Skull, greatest length 23·6 ; occipito-nasal length 21·4 ; zygomatic breadth 14·6 ; breadth across muzzle astride canines 7·3 ; palato-sinual length 10·8 ; front of canine to back of m^3 7·3.

Hab.—Upper Burma. Type from Mogok.

Type.—Adult female in spirit. B.M. No. 4. 4. 27. 1. Collected and presented by Mr. Herbert Hampton. Two specimens.

This fine species is readily distinguishable by its larger skull, and the great development of the muzzle and canines.

Attention should be called to the fact that in this genus, as shown by our good series of *H. harpia* from Java, the female is larger than the male, the difference being especially conspicuous in the skulls. Whether this is known to occur in other genera of Microchiroptera I do not know. In the Megachiroptera the size difference between the sexes appears, as a rule, to have been found so slight that Dr. Andersen did not think it worth while to take notice of it in his average measurements. He states, however, that in *Eidolon* the females "average a trifle larger than the males," while, on the other hand, the males of *Epomops, Hypsignathus, Epomophotus* and *Eonycteris* "average noticeably larger" than females.

A COLLECTION OF MAMMALS MADE BY H. STEVENS, IN THE DARJEELING DISTRICT.

LIST AND REMARKS.

BY

T. B. FRY.

(1) KERIVOULA HARDWICKEI, Horsf.

Hardwicke's Bat.

(Synonymy in No. 26).

Gopaldhara ? 1.

(2) TUPAIA BELANGERI LEPCHA, Thos.

The Sikkim Treez Shrew.

1922. *Tupaia belangeri lepcha,* Thomas, J.B.N.H.S. xxviii. p. 428.

Mongpu Hills ♀ 2. juv.

This animal was originally referred to *T. b. chinensis* in Reports Nos. 27 and 28, but when dealing with this genus at a later period Mr. Thomas decided to divide it into several subspecies and gave the name *Tupaia belangeri lepcha* to the animal found in Sikkim, Bhutan, Duars and the Darjeeling District.

(3) TALPA MICRURA, Hodgs.

The Short-tailed Mole.

(See also Reports Nos. 26 & 38.)

Gopaldhara ♂ 2.

(4) PACHYURA sp.

Gopaldhara ♂ 2, ♀ 12.

Many specimens of the larger shrews were obtained by the Survey in Darjeeling, Kalimpong and the Duars. The genus, as a whole, has still to be studied.

(5) CROCIDURA RUBRICOSA, Ands.

Anderson's Assam Shrew.

(Synonymy in No. 25).

(See also Reports Nos. 37 & 38).

This shrew was not obtained by the Survey Collector in the Darjeeling District although probably it is not uncommon.

(6) CANIS INDICUS, Hodgs.

The Jackal

(Synonymy in No. 1 under C. aureus).

(See also Reports Nos. 15, 16, 19, 20, 25, 27, 28, 37, 38).

Dkayti, Nepal Front.... ? 5. all imm.

(7) TOMEUTES LOKROIDES, Hodgs.

The Hoary-bellied Himalayan Squirrel.

(Synonymy in No. 23).

(See also Reports Nos. 26, 28, 37).

Gopaldhara .. ♂ 2, ♀ 1.; Mongpu Hills. .. ♂ 9, ♀ 10, ? 3.

(8) Gunomys bengalensis, Gray and Hardw.

The Bengal Mole-Rat.

(Synonymy in No. 15 under *G. tarayensis*).

(See also Reports Nos. 19, 20, 23, 26, 27, 28, 37, 38).

Gopaldhara .. ? 1.

(9) Rattus fulvescens, Gray.

The Chestnut Rat.

(Synonymy in No. 15).

(See also Reports Nos. 14, 17, 23, 25, 26, 28, 36-38).

Mongpu Hills .. ♀ 1.

The specimens recorded in Report No. 14 as *Epimys jerdoni* were subsequently found to be *Rattus fulvescens.*

(10) Rattus nitidus, Hodgs.

Hodgson's Grey-bellied Rat.

(Synonymy in No. 15).

(See also Reports Nos. 23, 26, 28, 37).

Gopaldhara .. ♂ 10, ♀ 9,? 4; Mongpu Hills .. ♂ 2, ♀ 2.

(11) Rattus tistæ, Hint.

The Teesta Tree-Rat.

1918. *Rattus rattus tistœ.* Hinton, J.B.N.H.S. xxvi, p. 68.

(See also Reports Nos. 23, 26, 28).

Gopaldhara .. ♂ 28, ♀ 41; Mongpu Hills .. ♂ 1, ♀ 1.

When working out the Indian Rats, Mr. Hinton gave this name to those noted in the above mentioned Reports as "Varieties with white under parts."

(12) Mus dubius, Hodgs.

The common Indian House-Mouse.

(Synonymy in No. 5 under *M. manei*).

(See Reports Nos. 6, 8-16, 18-20, 22, 23, 26-28, 30, 31, 34).

Gopaldhara .. ♂ 31, ♀ 66, ? 5; Mongpu Hills. .. ♂ 1, ♀ 1.

(13) Mus homourus, Hodgs.

The Himalayan House-Mouse.

(Synonymy in No. 15).

(See also Reports Nos. 23, 26-28.)

Gopaldhara .. ♂ 7, ♀ 20, ? 3.

The mice included under this name have blue-grey coloured under parts as mentioned by Mr. Wroughton in Report No. 15, and are clearly distinct from *M. dubius.* The whole genus will eventually have to be dealt with, but for the present the above name must be retained.

(14) Leggada booduga, Gray.

The Southern Field-Mouse.

(Synonymy in No. 1).

(See Reports Nos. 2, 4-13, 15, 16, 18-22, 25, 27, 30, 31, 34, 37).

Gopaldhara .. ♂ 4, ♀ 7.

This genus also demands further study.

(15) LEPUS RUFICAUDATUS, Geoff.

The common Indian Hare.

(Synonymy in No. 15).

(See also Reports Nos. 19, 21, 23, 26, 27, 37).

Mongpu Hills ♂ 1, ♀ 2. juv.

The collection contains 302 specimens, representing 12 genera and 15 species, and was made during the months of April and May 1921.

About 244 of the total number are of well known rats and mice, while the remainder belong to species which have previously been obtained by the Survey; consequently the collection may be regarded as supplementary to the work done by N. A. Baptista in the Darjeeling and adjoining districts. For the sake of convenience in the matter of reference, etc., the list is submitted in the usual report form.

THE TERRESTRIAL ISOPODA OF MESOPOTAMIA AND THE SURROUNDING DISTRICTS.

BY

JOSEPH OMER-COOPER, F.L.S.

(*With* 6 *plates and* 2 *text figures.*)

During the last two years collections of Woodlice from the Mesopotamian Region have been sent to me for identification by Mr. Robert Gurney, M,A., Mr. W. Evans and Mr. R. G. Tame, and the specimens in the British Museum have also been examined. These collections contain in all about 150 specimens representing sixteen species of which six appear to be undescribed.

The identification of the specimens has been much facilitated through the kindness of the British Museum authorities, who placed their very extensive collections at my disposal, including the whole of the Budde Lund collection.

Through this I was able in the majority of cases to confirm the identification of the less common species by direct comparison with the type specimens. The Budde Lund manuscript was also consulted and proved of the greatest assistance.

I take this opportunity of expressing my most sincere thanks to the Museum authorities, and in particular to Dr. W. T. Calman, F.R.S., for the kindness which he has shown in giving me every facility to examine the specimens and consult the literature, and also for personally assisting me in the translation of various foreign publications.

The collections show no very striking features, most of the species being found also in Algeria, Egypt or Southern Europe, while the new species are also closely allied to species found in these regions, with the exception of *Periscyphis Tamei*, Sp. n., which appears to be most closely related to certain Central African forms.

The discovery of specimens of *Hemilepistus pectinatus*, Budde Lund, is however of considerable interest as they possesses free coxal plates on the 2nd, 3rd and 4th trunk segments, a feature unknown previously in any normal genus of the Oniscoidea.*

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* Since this paper was in the hands of the printer I have found in a paper by Dollfus a reference to these coxal plates which is as follows :—

ANOMALONISCUS. Gen. Nov.

"Ce genre qui paraît se rapprocher du genre *Alloniscus* Dana. s'en distingue par le singulier charactère suivant chez les ♀ les parties latérales des segments 2, 3 et 4 du pereion présentent une division très nette qui dèlimite un large coxopodite, analoque à celui qui s'observe dans le genre *Ligia*. Cè charactère est d'autant plus extraordinaire qu'il est limité à un petit nombre de segments et qu'il ne s'obse ve pas chez le mâle. Voici du reste la diagnose du genre" Adrian Dollfus 1893 Bull Soc. Zool de France. Tom XVIII p. 187.

Examination of the specimens of Alloniscus in the collection of the British Museum reveals the fact that the majority of species have a suture or groove between the coxal plate and the tergum in the 2nd, 3rd and 4th trunk segments only, and that this character is confined to the female sex.

I have also received a letter from Mr. Harold Jackson, M.Sc., who has been working upon the genus *Ligia* and who kindly examined a number as regards their coxal plates. His observations appear to me to be of considerable interest and I am therefore quoting the greater part of his letter.

"Your request has incited me to look into the point at once in the hope it will be of use to you and I have examined some 50 *Ligia* to-day with the following results : 24 of the specimens were male and 23 female." By "every segment" I mean "every thoracic segment."

Ligia exotica, Roux.

♀ 2, 3 and 4 separated by very deep grooves 1, slightly grooved, 5, 6, 7 progressively less deeply grooved towards the metasome.

♂ Exceedingly faint indications only (as a matter of fact I can quite excuse anyone unprovided with a first rate binocular miscroscope not seeing them at all).

L. pallasii, Brandt.

♀ Coxa on every segment separated by very deep grooves.

That another species, *Porcellio Calmani*, Sp. n., which shows this structure, should be found in the same district, is a remarkable coincidence especially as the genus *Porcellio* (to which *Hemilepistus* is very closely related is of great size and very widely distributed.

It is possible that a careful examination of the known species of *Porcellio* might reveal the presence of free coxal plates in other species as the suture lines are not very conspicuous, but though I have examined a considerable number of species I have not so far observed it.

In the examination of this collection, though no very large number of specimens were dissected, the variability of certain features was very noticeable.

A number of species from Northern and Central Africa and Great Britain have also been examined and these have also proved very variable.

In the majority of cases species have been described from specimens of one sex only and not infrequently from single specimens and as this fact is often omitted from the description considerable confusion arises.

The chief features in which I have found the sexes to differ are as follows:—

The size and distribution of the tuberculations.

The size and shape of the lobes of the head, though, this is rarely well marked.

The structure of the epistome, though but slightly.

The comparative and total length of the joints of the antennal flagellum.

The number of brushes on the mandibles and their distribution.

The shape, size, number and notching of the teeth of the outer endite of the maxillula.

The size and number of the spines of the peraeopoda. This is usually well marked especially in the first pair.

The shape and size of the second joint of the seventh peraeopod especially in *Periscyphis* and allied genera where it is usually very marked.

The length of the uropoda which are often much longer in the male than the female especially in the genus *Porcellio,* where in some South European and North African forms, the length of the uropoda in the male is very great.

♂ 2—6 deeply separated. Others with distinct shallow grooves

L. Oceanica (Linn).

♀ Very deep grooves separating coxa on every segment.

♂ Distinct or deep grooves on every segment.

L. Olfersii, Brandt.

♀ 2, 3 and 4 very deeply grooved. In other segments absent or very faintly marked.

♂ Exceedingly faint indication or no trace of a division,

L. Cinerascens, B-L.

♀ Very distinct grooves on every segment.

♂ Very faint indications only.

L. Novae-Zealandica Dana.

♀ 2, 3, and 4 very deeply grooved, other segments more or less well marked.

♂ No specimens in my possession.

The result of this small investigation seems to me very interesting.

It is very obvious that the presence or absence of separated coxa in the *male only* is not without specific importance, as the character is remarkably constant in the species.

The females all agree in having the character more strongly marked in segments 2, 3 and 4 than any male. It is more or less marked in the other segments, but not so specifically distinct as to have much value.

(Signed) HAROLD G. JACKSON.

The principal variations which I have noticed amongst individuals of the same sex are :—

Size.—Very considerable differences are often found between individuals apparently adult.

Colour.—

The tuberculation of the body, but variation in this respect is not great.

The size and shape of the lobes of the head which vary to some extent with age and sex.

The development of the coxal and pleural plates and the degree of sinuosity of the hinder margins of the trunk segments, though this is not very well marked, is of some importance as these features have been made much use of by some systematists.

Number of ocelli.

Number of " olfactory " setae on the antennule.

Length of the joints of the antennal flagellum, though variation in this is usually slight

Number of brushes on the mandibles, and their arrangement. This character seems particularly variable.

The remaining mouth parts and the uropoda also show occasional variation, but this is not usually well marked.

A list of the species with the number of specimens from each locality is given below :—

List of species.	Amara.	Baghdad.	Kizil Robat.	uz N.E. of Baghdad.	Mosul and Korind.	Baku.
Cubaris officionalis (Dumeril)	19	..	4	..	..	..
Periscyphis (=*Cercocytonus*) *Tamei*, Sp. n.	2	..	..	4	..	..
Pareluma minuta, Sp, n.	9	..	..	..	..	..
Porcellio (*Porcellio*) *blattarius*, B-L.	2	..	..	..	..	..
,, (*Porcellio*) *Evansi*, Sp. n.	7	2	1	..	..	..
,, (*Rogopus*) *lævis* (Latr.)	5	10	..	..	..	..
,, (*Rogopus*) *Calmani*, Sp. n.	..	..	..	..	..	8
,, (*Angara*) *lenta* (B-L.)	3	..	..	..	..	..
,, (? *Agabiformis*) *rufobrunneus*, Sp. n.	5	..	..	..	..	..
Hemilepistus pectinatus, B-L.	..	..	..	..	15	..
Leptotrichus politus, Sp. n.	8	..	..	..	..	..
Porcellionides (=*Metaponorthus*) *litoralis* (B-L.)	9	..	..	..	..	..
,, ,, *swammerdami*, (Aud. & Savig.)	19	2	1	..	..	..
,, ,, *uniformis* (Koch).	8	..	..	..	..	..
,, ,, ? *pruinosus* (Brandt).	2	..	..	..	..	..
Philoscia elongata, Dollf.	7	...	..	..	..	..
	14	3	3	1	1	1

Cubaris officionalis (Dumeril).

Dumeril, 1816.

Localities.—Amara : Capt. P. A. Buxton, Capt. W. E. Evans, Mr. R. G. Tame.

Kizil Robat, N. E. of Baghdad: Capt. W. E. Evans, 4 specimens.

Periscyphis (=*Cercocytonus*) *Tamei*, sp. n. (Plate I).

Localities.—Amara: Mr. R. G. Tame, 2 specimens.

Ruz, N. E. of Baghdad: Capt. W. E. Evans, 4 specimens.

Description.—Body convex, capable of rolling into a ball, nearly smooth with a few small irregularly scattered setae and minute punctations.

Head with the lateral lobes small and the front straight. Epistome without marginal line and nearly flat. Antennal tubercles small and thin walled: clypeus rising steeply from the epistome which is slightly raised in the middle close to the origin of the clypeus. Eyes of moderate size with about 15 ocelli.

Mesosome with the coxal plate of the 1st free segment raised to form a rounded ridge separated by a deep groove from the tergum. This groove ends blindly behind, but in front is continued as a narrow and shallow depression which runs round the anterior edge of the segment behind the raised line which forms the articular edge; the outer collar line being a continuation of the raised coxal plate. The raised coxal plate is of a pale yellow colour and marked by numerous fine longitudinal striations; a condition which appears general where such raised coxal plates occur, for in all the species of *Microcercus*, etc., which I have examined, they have a similar appearance.

The hinder margin of the 1st segment nearly straight; the posterior angles rounded, with a deep notch which receives the edge of the 2nd segment when the animal rolls up: 2nd, 3rd, 4th, 5th and 6th segments with the hinder margins nearly transverse, without sinuosity, and the posterior angles rounded and entire: 7th segment with the posterior angles somewhat posteriorly produced and rounded.

Metasome with the pleural plates of the 3rd, 4th and 5th segments quadrangular.

Telson triangularly produced in the middle, and the apex a little rounded.

Antennules with three joints, the 2nd and 3rd joint being subequal and the 1st a little longer than the other two together; apex with about 12 "olfactory" setæ.

Mandibles: Right with 2 brushes. Left with 3.

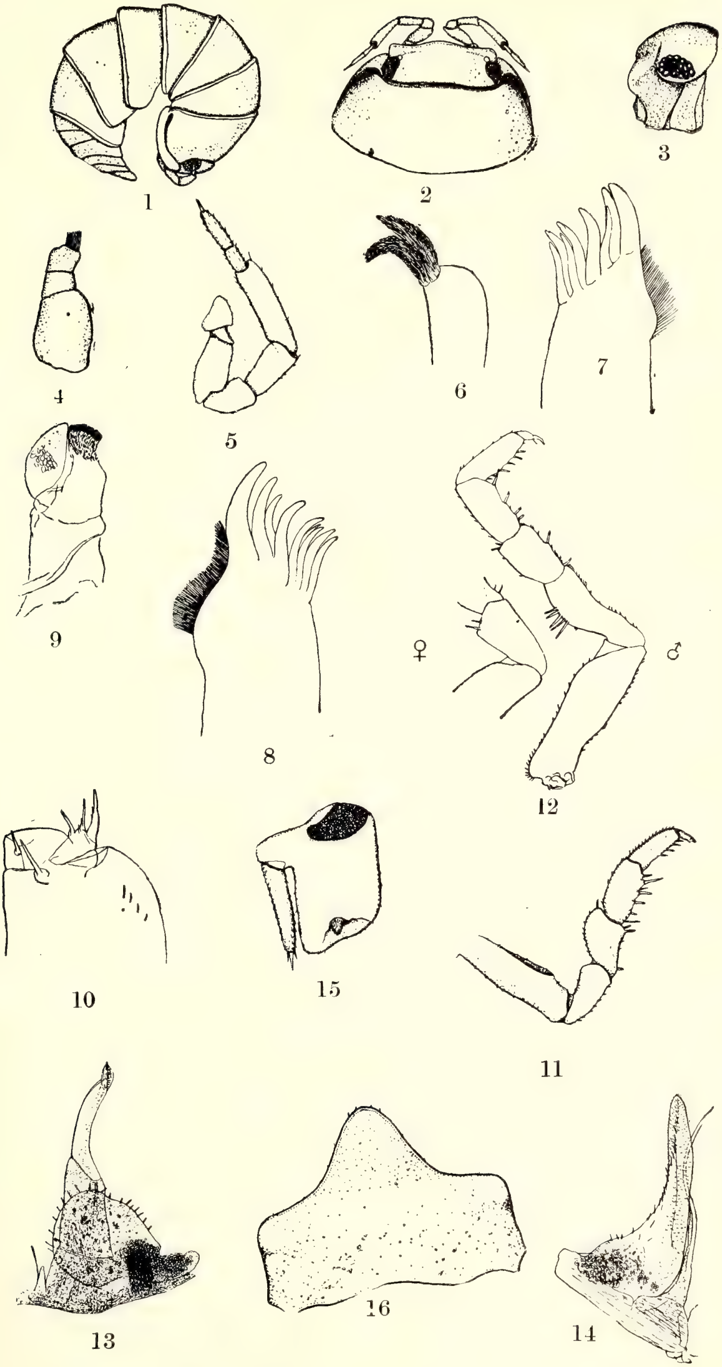
Antennæ slightly longer than the 1st trunk segment, 2nd joint a little longer than the 3rd which is slightly shorter than the 4th; flagellum biarticulate, the 1st joint about $\frac{1}{4}$th shorter than the 2nd.

Maxillulæ: Inner endite without posterior spine, with two long slender brushes, the lower being the longer. Outer endite in the female with 4 major teeth, all well developed, though the 2nd is slender, and 4 minor teeth, the 1st and 3rd slightly notched. In the male there are 4 major and 5 minor teeth and both are rather more curved than in the female. The minor teeth all have the apex entire or nearly so. It is possible that one of these conditions is abnormal as I have only dissected the two specimens.

Maxillae with the outer lobe a little wider than the inner, and without a basal lobe on the outer margin.

Maxilliped with the last joint of the palp produced as a stout spine. Middle region with two stout spines each having a small spine at the base, and there is a third small spine between the two stout ones. The basal joint of the palp has a single stout spine. Endite with one spine and without teeth.

Peraeopoda show marked sexual dimorphism especially noticeable in the number of spines carried by the 1st pair, which is small in the female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Periscyphis (=*Cercocytonus*) *Tamei,* sp. n.

THE TERRESTRIAL ISOPODA OF MESOPOTAMIA AND THE SURROUNDING DISTRICTS.

Explanation of Plate I.

Periscyphis (=*Cercocytonus*) *Tamei*, Sp. n.

1. Adult female.
2. Head and 1st segment of female.
3. Head of female side view.
4. Antennule of male.
5. Antenna of male.
6. Inner endite of maxillula of male.
7. Outer endite of maxillula of female.
8. Outer endite of maxillula of male.
9. Maxilla of male.
10. Maxillipede of male.
11. 1st peræopod of female.
12. 7th peræopod of male and part of 7th peræopod of female.
13. 1st pleopod of male.
14. 2nd pleopod of male.
15. Uropod of male.
16. Telson of male.

and large in the male, and in the 2nd joint of the 7th pair, which is short and stout in the female, and long and narrow in the male.

Pleopoda : 1st two pairs with pseudotracheæ.

Uropoda with basal joint flattened ; endopodite reaching nearly to the end of the telson, and the exopodite very small, and situated in a shallow pit on the upper surface of the basal joint a little behind its distal margin in a medium position.

Colour—Pale lemon yellow with dark chocolate markings. The coxal plates are yellow for the greater part of their width and in the anterior region of the segments this light area extends considerably on to the tergum but just behind the posterior margin—which is itself nearly white—there is a narrow dark band running nearly to the lateral margin of the segment. The median dark area is narrow anteriorly but becomes broader posteriorly, being widest in 5th, 6th, and 7th trunk segments. There are small light markings running down the median line. The head is yellow with a few indistinct dark mottlings. The metasome has the first two segments yellow and the last three somewhat darker with the pleural plates nearly white. The telson and uropods are very pale yellow and the legs and pleopods are nearly white.

Length, 10 m.m. *Breadth,* 4 m.m.

Remarks—This species is placed in the genus *Periscyphis* for the following reasons :—

Budde Lund 1885, formed the genus *Cercocytonus,* which he later 1908 (*a*) considered to be equivalent to Gerstaecker's *Periscyphis,* 1873. In 1910 he restricted the genus considerably, re-defined Dollfus *Synarmadillo,* and created the new genus *Microcercus.* More recently Stebbing, 1911, has formed the genus *Paraperiscyphis,* which is easily distinguished from Budde Lund's genera, and Pearse, 1915, the genus *Minca,*—which he has not very clearly defined and which appears to be very close to *Microcercus.* Collinge, 1914, considers *Periscyphis,* Gerst., distinct from *Cercocytonus,* B. L., which further complicates the matter and the whole group is badly in need of revision.

To add to the confusion, by the addition of a new generic name, would seem undesirable. I therefore place the species described above in the genus *Periscyphis,* while pointing out that it cannot be included in that genus as defined by Budde Lund, 1910, nor in any of the allied genera as he restricts them. It shows a close relationship in some respects to the genus *Microcercus* which is confined to Africa.

Pareluma, Gen.n.

Definition—Body convex, capable of rolling into a ball. Head with lateral lobes small, and antennal tubercles forming two curved and narrow ridges. Eyes small with several ocelli. 1st segment of the mesosome with the lateral margins thickened and notched posteriorly to receive the coxal plate of the 2nd segment. Flagellum of antenna biarticulate, the 2nd joint at least twice as long as the 1st. Telson triangular. Uropoda similar to those of *Armadillidium.*

Generotype—*Pareluma minuta,* Sp.n.

Remarks—This genus is very near to *Eluma* but may be easily distinguished from it by the eyes, which consist of but one ocellus in *Eluma.*

The following species are included :—

Armadillidium Davidi, Dollf.		*Armadillidium hybridum,* B. L.	
,, *Festie,*	,,	,, *Oertzenii,*	B. L.
,, *fissum,*	,,		
,, *granum,*	,,		

Pareluma minuta, Sp.n. (Plate II).

Locality—Amara: Capt. W. E. Evans, 13th November 1918.

9 female specimens.

Description—Body convex, capable of being rolled into a ball; surface smooth, with a few setae irregularly scattered.

Head with the lateral lobes small and the front almost straight. Epistome with distinct marginal line, and a median tubercle forming a distinct ridge. Antennal tubercles well developed, forming two curved ridges running upwards and inwards. Eyes small with about 6 ocelli.

Mesosome with the 1st free segment notched to receive the coxal plate of the 2nd. Edges of all the coxal plates a little thickened: Collar line indistinctly double, the outer line becoming obsolete in the middle dorsally.

Posterior angles of all the segments rounded and hinder margins nearly transverse.

Metasome with the pleural plates of the 2nd, 3rd and 4th segments subquadrangular.

Telson triangular with the apex broadly rounded.

Antennulæ three jointed, 1st joint about $\frac{1}{3}$rd longer than 3rd, 2nd very short; apex with about 7 " olfactory " setæ.

Antennæ reach to the 3rd trunk segment.

The 2nd, 3rd and 4th joints subequal, the 3rd being the shortest while the 4th is a little longer than the 2nd, and the 5th about as long as the 3rd and 4th together. Flagellum biarticulate and about as long as the 5th joint of the peduncle; the 2nd joint about 3 times as long as the 1st and with a stout apical bristle.

Mandibles: Right with 3 brushes, one on the setose pad and two below. Left with 5 brushes, two on the pad and three below.

Maxillulæ: Inner endite with a rather long posterior spine and two short and moderately stout brushes. Outer endite with 4 major teeth—of which the 2nd is very slender but only slightly shorter than the others—and 5 minor teeth—all with the apex entire.

Maxillæ with the outer lobe wider than the inner, and a basal lobe on the outer margin.

Maxillipedes with the last joint of the palp ending in a tuft of setæ; middle region with two stout spines—the inner being the longer; and basal joint with two stout setæ. Endite with a single setæ and three teeth, of which the outer is of medium size, the middle large and curved, and the inner very small.

Pleopoda—1st two pairs only with pseudotracheæ.

Uropoda similar to those of *Armadillidium*: basal joint notched externally: Endopodite flattened, reaching just beyond the telson: Exopodite slightly shorter than the endopodite, flattened, nearly quadrangular.

Colour—Reddish brown with pale yellow or brown spots. Coxal plates pale yellow. Antennae brown, legs, pleopods and uropods nearly white.

Length, 5 m.m. *Breadth,* 2 m.m.

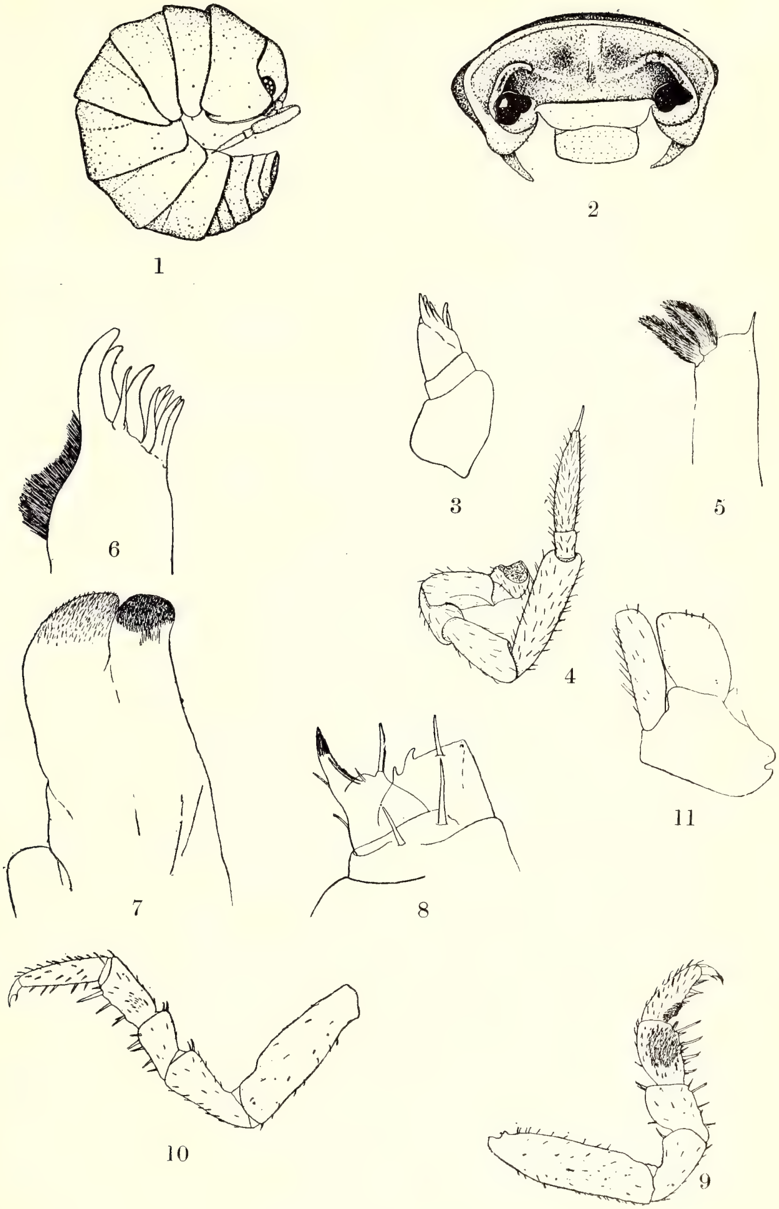
Porcellio (Porcellio) llattarius, B. L.

Budde Lund, 1885, p. 131.

Locality—Amara. April-May 1918, Capt. P. A. Buxton, 2 ♀ specimens.

Description.—Body oblong oval, not very convex; surface smooth, with fine setae, punctations, and a few small tubercles, most prominent posteriorly.

Head with lateral lobes well developed and rounded; median lobe small, semicircular, and entire. Epistome raised in the middle but without a median tubercle in the female, Budde Lund's description " Epistoma medio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Pareluma minuta, sp. n.

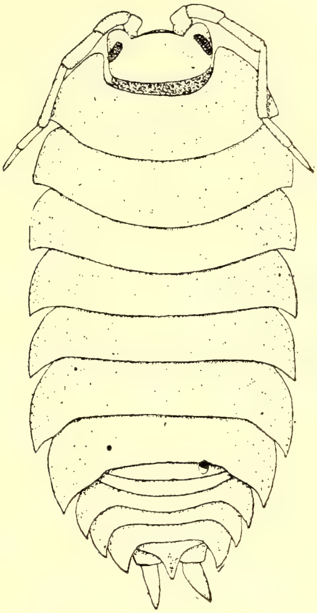
THE TERRESTRIAL ISOPODA OF MESOPOTAMIA AND THE SURROUNDING DISTRICTS.

Explanation of Plate II.

Pareluma minuta, Sp. n.

1. Female, ? Adult.
2. Head of female front view.
3. Antennule of female.
4. Antenna ,,
5. Inner endite of maxillula of female.
6. Outer endite of maxillula of female.
7. Maxilla of female.
8. Maxillipede ,,
9. 1st peræopod of female.
10. 7th peræopod of ,,
11. Uropod of ,,

tuberculo obtuso" applies to the male only. Eyes composed of about 25 large ocelli.



Text Fig. 1. *Porcellio* (*Porcellio*) *blattarius,* B. L.

Mesosome with the posterior margins of the 1st, 2nd and 3rd segments a little sinuous and the hinder angles sharp. Anterior articular surface of 1st segment with a single collar line dorsally.

Metasome with the pleural plates of the 3rd, 4th and 5th segments triangular and the angles sharp pointed.

Telson subtriangular, with the sides incurved and the apex subacute. Dorsal surface markedly excavated towards the apex.

Antennæ reaching a little beyond the posterior margin of the 2nd trunk segment: 2nd and 3rd joints subequal, the third slightly the longer and both obtusely dentate, 4th joint about ⅓rd longer than the 3rd, and 5th as long as the 3rd and 4th together.

Flagellum biarticulate, nearly as long as last joint of peduncle; 1st joint a little longer than 2nd in both sexes. Budde Lund's description "Flagelli articulus prior altero fere duplo longior" does not agree with the female specimens from Mesopotamia, nor with the male specimen in his own collection; but I have found that the comparative length of the joints of the flagellum varies somewhat with age and sex in the genus *Porcellio.*

Maxillulæ : Inner endite with a small curved posterior spine and two brushes, of which the lower is the longer. Outer endite with 4 major and 6 minor teeth of which the 1st, 3rd, 4th and (?) 6th are notched and the 2nd and 5th slender and entire.

Maxillipedes with the palp ending in a tuft of small setæ ; the middle region with 2 spines, the outer with 3 and the inner with one seta at the base. Endite with one spine and 3 teeth of which the innermost is small.

Pleopoda: 1st two pairs only with pseudotracheæ. 1st pair in the female large subquadrangular nearly meeting in the middle line.

Uropoda with the basal joint rather widely notched externally: endopodite projecting very slightly beyond the extremity of the telson: exopodite short, lanceolate, with a ridge externally.

Colour—Grey, with a series of white marks near the bases of the coxal plates, and a white spot at a short distance from the margin of each segment near to the hinder angle. There are also obscure yellow and reddish markings on the back. Antennæ dark grey, legs and uropods nearly white.

Length, 17 m.m. *Breadth*, 8 m.m.

Remarks—This species is represented in the Budde Lund collection by a single small male specimen of a yellowish brown colour—which is probably due to its having been kept for many years preserved in alcohol in a corked tube. It has been carefully compared with the female specimens from Amara and the points of difference are so slight that there can be little doubt that they belong to the same species.

As a certain amount of confusion has existed regarding this species (see Budde Lund M.S.) and the original description is insufficient I have redescribed it above from the two females from Amara.

Porcellio (*Porcellio*) *Evansi*, Sp. n. Plate III.

Localities—Amara, Capts. C. L. Boulenger, P. A. Buxton and W. E. Evans.

Baghdad: Capts. C. L. Boulenger and W. E. Evans. Kizil Robat N. E. of Baghdad: Dec. 1918, Capt. W. E. Evans.

Description—Body oblong oval, moderately convex, with the coxal plates somewhat flattened; surface with numerous tubercles arranged in irregular transverse rows.

Head with the lateral lobes well developed, rounded and sloping slightly upwards; frontal lobe obtusely triangular and deeply notched in the middle, the sides of the notch being raised as distinct prominences. In one specimen examined these had coalesced so that the apex of the triangular frontal lobe was entire and appeared as a single upwardly directed prominence. Epistome flattened, with distinct marginal line, and a well developed median tubercle, which has its apex sharp pointed and directed upwards. It may be seen from the dorsal surface as a small pointed tubercle projecting as far as the two median prominences of the frontal lobe and visible in the notch between them. Eyes with about 25 large ocelli.

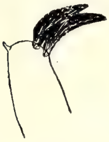
Mesosome with the coxal plates projecting laterally: anterior articular surface of the 1st segment with an indistinctly double collar line: 1st, 2nd and 3rd segments with the hinder margin sinuous and the posterior angles acute.

Metasome with the pleural plates of the 3rd, 4th and 5th segments triangular and the angles sharp pointed.

Telson sub-triangular, with the sides much incurved and the apex very slightly rounded.

Antennulæ with the 1st joint twice as long as the 2nd, which is $\frac{1}{3}$rd shorter than the 3rd; a small patch of "olfactory" setæ near the apex.

Antennæ reaching to the posterior margin of the 3rd trunk segment: 2nd and 3rd joints subequal, the 3rd being the longer, 4th about $\frac{1}{3}$rd longer than 3rd, 5th as long as the 3rd and 4th together. Flagellum biarticulate, 1st joint about $\frac{1}{3}$rd longer than the 2nd in the female, while in the male it is twice as long. This is a well marked sexual difference,



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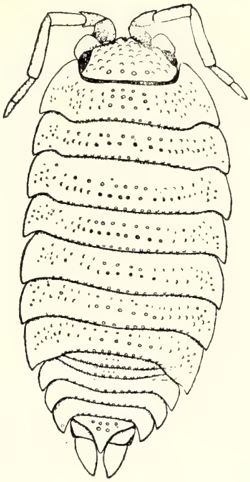

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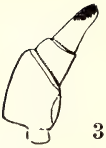

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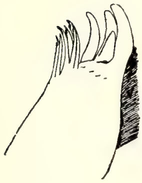

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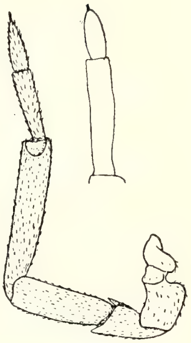

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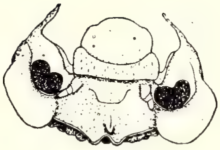

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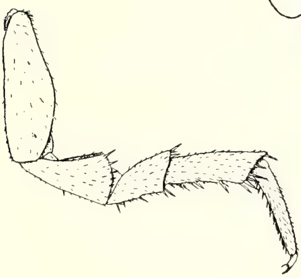

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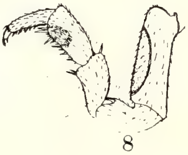

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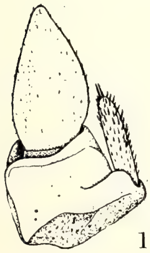

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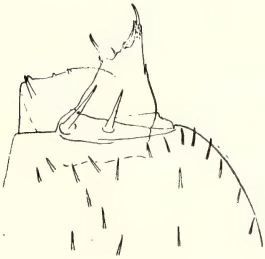

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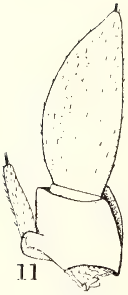

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Porcellio (*Porcellio*) *Evansi*, sp. n.

THE TERRESTRIAL ISOPODA OF MESOPOTAMIA AND THE SURROUNDING DISTRICTS.

Explanation of Plate III.

Porcellio (*Porcellio*) *Evansi*, Sp. n.

1. Adult female.
2. Head of female front view.
3. Antennule of female.
4. Antenna of female and flagellum of male.
5. Inner endite of maxillula of female.
6. Outer endite of maxillula of female.
7. Maxillipede of female.
8. 1st peræopod of female.
9. 7th ,, ,, ,,
10. Uropod of female.
11. Uropod of male.

though the relative lengths of the joints of the flagellum show a certain amount of variation amongst the female specimens examined.

Mandibles : Right with 5 brushes, all below the setose pad. Left with 9 brushes, 2 arising from the pad.

Maxillulæ : Inner endite with posterior spine small and curved and two long slender brushes. Outer endite with 4 major and 6 minor teeth, of which the 1st, 2nd, 3rd, 4th and 6th have the apex deeply notched on the inner side.

Maxillæ similar to those of *P. scaber*.

Maxillipedes with the last joint of the palp ending in a long curved and slender spine, below which are a number of small spinous setæ : middle region with two long slender spines, each with a small setæ at the base, between is a third small spine ; basal joint with 2 stout setæ. Endite with 3 small teeth of which the innermost is largest. Basipodite markedly imbricated, with numerous stout setæ scattered irregularly all over it.

Pleopoda with 1st two pairs only with pseudotracheæ. 1st pair subquadrangular and do not meet in the middle line though not widely separated.

Uropoda : Endopodite not projecting beyond telson : Exopodite rather small, considerably dorso-ventrally flattened in both sexes, but more conspicuosly in the male, in which it is also large.

Colour—Bright yellow with the tuberculation dark grey or brown : head dark grey : metasome with a broad dark band covering segments 3, 4, and 5 with the exception of their pleural plates, which are nearly white. Telson yellow, with one or two dark blotches. Uropoda yellow at base shading to dark grey brown at apex. Legs and pleopods light yellow.

Length, 14 m.m. *Breadth*, 6-5 m.m.

Remarks—This species though apparently abundant and rather striking in appearance does not seem to have been described previously.

It belongs to the sub-genus *Porcellio*, as defined by Budde Lund, and is very like the *Porcellio magnificus* of Dollfus (1892), but differs from it in its smaller size and in the shape of the uropods.

Porcellio (*Angara*) *lenta* (B.L.)

Budde Lund, 1885, p. 230.

Locality—Amara : Capt. P. A. Buxton, 3 specimens.

Porcellio (*Rogopus*) *lævis*, Latr.

Latreille, P. A., 1804.

Localities—Amara. Feb. 1918. Capt. W. E. Evans, 4 specimens. Baghdad. 12th Sept. 1917. Capt. P. A. Buxton, 10 specimens.

Porcellio (*Rogopus*) *Calmani*, Sp.n. Plate IV.

Locality—Baku : 1919, Capt. P. A. Buxton, 8 ♀ specimens

Description—Body oblong oval, not very convex, surface smooth and punctate, with a few ill-defined corrugations.

Head with the lateral lobes small and curved outwards, and median lobe very small and arched. The epistome smooth and arched, without median tubercle ; marginal line distinct, and continuous with the edges of the lateral lobes. Eyes with 20—25 small ocelli.

Mesosome with the coxal plates of the 2nd, 3rd and 4th free segments separated from the tergum by clearly defined suture lines. The 1st, 2nd and 3rd segments with the posterior margins transverse, without sinuosity, and the hinder angles rounded.

Metasome rather sharply narrower than the mesosome, with the pleural plates of the 3rd, 4th and 5th segments triangular and sharp pointed.

Telson with the sides at first sloping sharply inwards and then bending at an obtuse angle to run straight to the apex, which is very sharply pointed. The produced middle portion forms a nearly equilateral triangle, slightly excavated dorsally.

Antennulæ with the 1st joint nearly twice as long as the 2nd, which is about the same length as the 3rd. Apex with a large number of short "olfactory" setæ.

Antennæ long and slender with the 2nd, and 3rd joints subequal, the 2nd being a little the shorter, both dentate ; 4th joint nearly as long as the 2nd and 3rd together, and about ¼th shorter than the 5th. Flagellum equal in length to the 5th joint of the peduncle, biarticulate, with the 1st joint about ¼th longer than the 2nd.

Mandibles both with 7 brushes, one of which is on the setose pad.

Maxillulæ : Inner endite with long and slender posterior spine, and two long slender brushes. Outer endite with 4 major and 6 minor teeth, all with the apex entire and sharp pointed.

Maxillæ with the inner lobe a little wider than the outer, which in the type specimen had the upper edge sloping downwards and nearly straight as figured both in the right and left maxillæ ; in another specimen however it was more rounded and of the usual type found in the genus *Porcellio.* There is a basal lobe on the outer margin.

Maxillipedes: Apex of the palp covered with small closely apposed setæ ; middle region with 2 stout spines, each with a small spine at the base ; basal joint with 2 spines. Endite with 2 teeth close to the palp, the inner distal angle is raised but does not appear to be a true tooth.

Peræopoda rather long, increasing considerably in length from 1st to 7th.

Pleopoda : 1st two pairs only with pseudotracheæ. 1st pair with the exopodites large and subtriangular.

Uropoda with the basal joint deeply notched externally : endopodite barely reaching to the apex of the telson : Exopodite long and lanceolate, with the inner edge almost straight, and the outer a little curved with a well defined ridge.

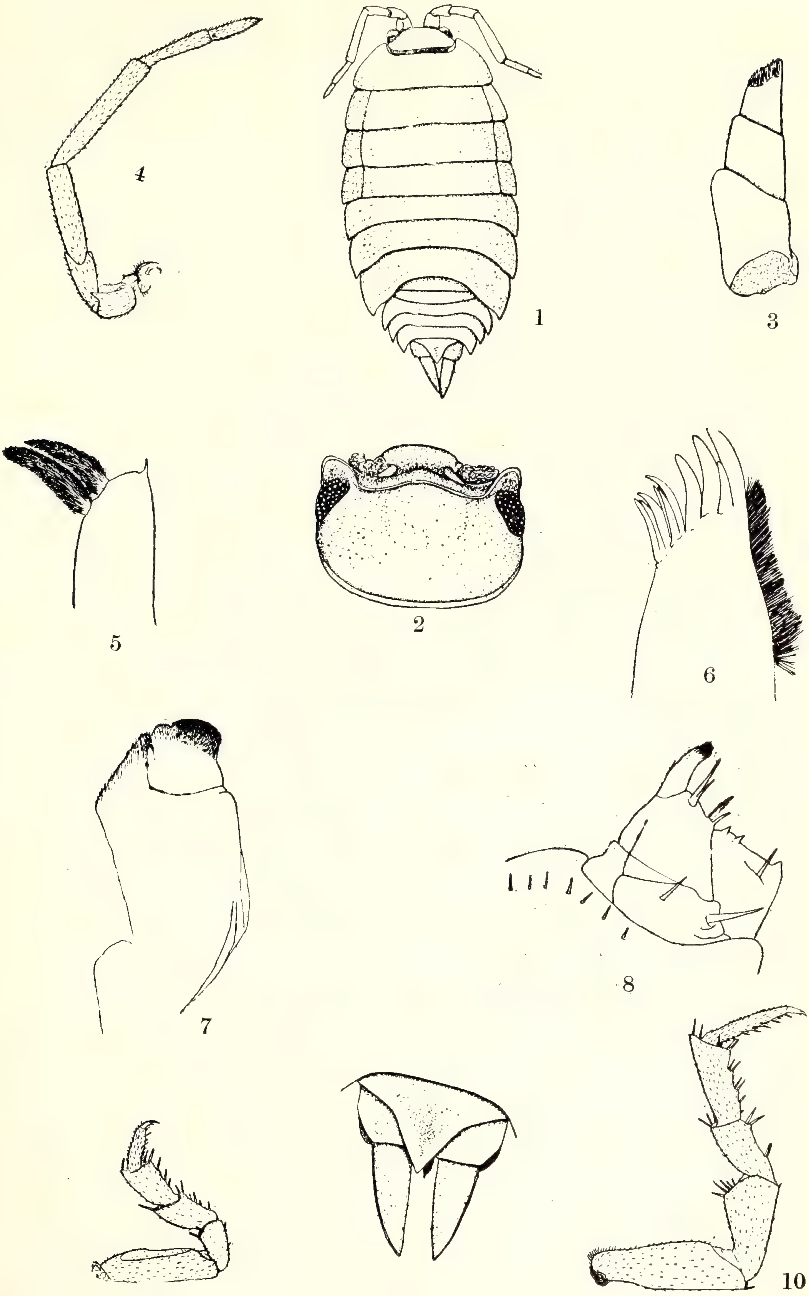
Colour—Purplish brown, with the hinder margins of the segments dark yellowish brown, sides of body with a white or pale yellow border.

Length, 18 m.m. *Breadth,* 8 m.m.

Remarks—This species which is of peculiar interest has been named after Dr. W. T. Calman, F.R.S., the celebrated Carcinologist as a mark of the great admiration and respect which I feel for him.

On an examination of the specimens upon which the description has been based, it was found that the coxal plates of the 2nd, 3rd and 4th free segments (3rd, 4th and 5th segments) of the mesosome were separated from the tergum by a well defined suture, a condition hitherto only known in the Oniscoidea in the aberrent genus *Tylos.* Dr. Calman in his volume on the Crustacea in Lankester's Treatise on Zoology, speaking of the suture line between the coxal plates and the tergum in the Isopoda, says:—"This condition is found in the *Cymothoidea, Serolidæ,* some *Sphæromidæ* and in the *Tylidæ* among the Oniscoidea. When the suture line disappears as in most Oniscoidea it is impossible to distinguish the coxal palate from a true pleuron."

In the *Ligiidæ* the coxal plate is marked off from the tergum by a depression, but thisis not a true suture. Possibly a more careful examination of the known species of Oniscoidea might result in the discovery of free coxal plates in others, as I have found a well marked suture in the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Porcellio (*Rogopus*) *Calmani*, sp. n.

THE TERRESTRIAL OSOPODA OF MESOPOTAMIA AND THE SURROUNDING DISTRICTS.

Explanation of Plate IV.

Porcellio (*Rogopus*) *Calmani*, Sp. n.

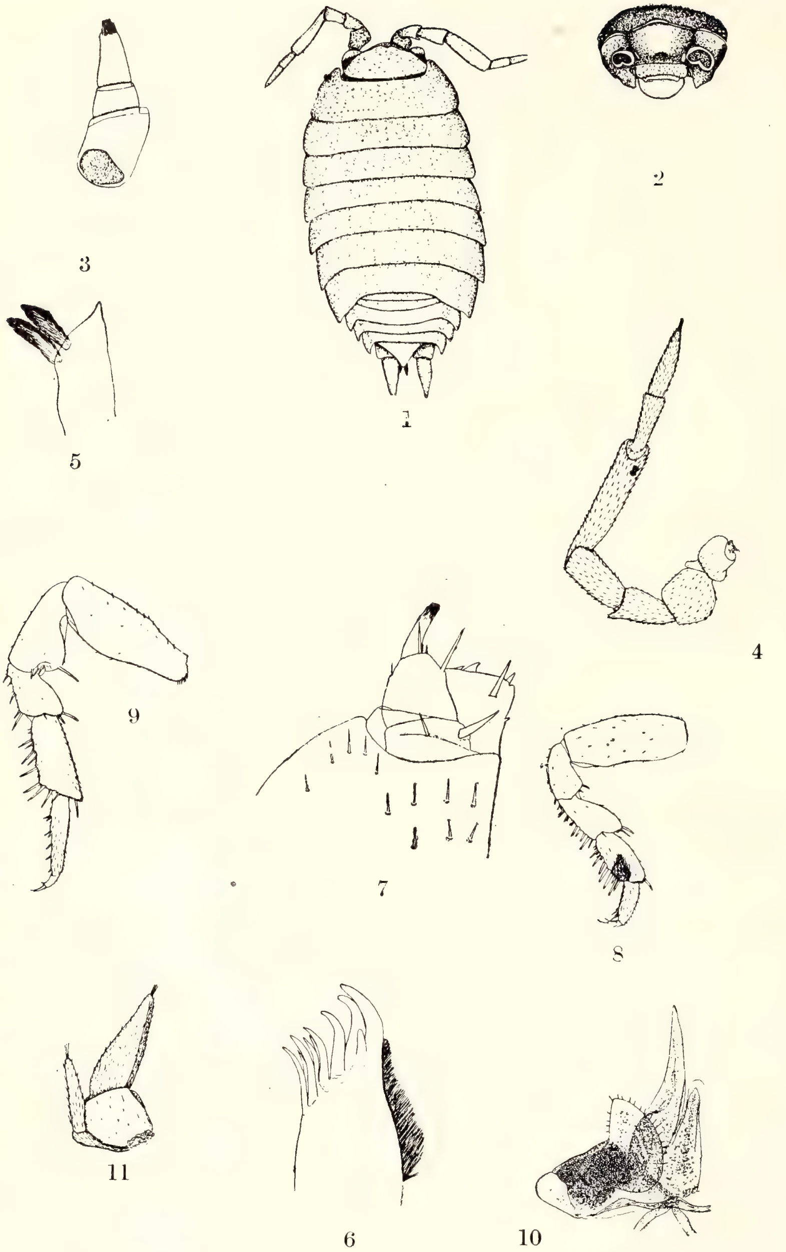
1. Adult female.
2. Head of female.
3. Antennule of female.
4. Antenna ,,
5. Inner endite of maxillula of female.
6. Outer endite ,, ,, ,, ,,
7. Maxilla of female.
8. Maxillipede of female.
9. 1st peræopod of female.
10. 7th ,, ,, ,,
11. Uropoda and Telson of female.

THE TERRESTRIAL OSOPODA OF MESOPOTAMIA AND THE SURROUNDING DISTRICTS.

Explanation of Plate V.

Porcellio (? Agabiformis) rufobrunneus, Sp. n.

1. Adult male.
2. Head of male front view.
3. Antennule of male.
4. Antenna of male.
5. Inner endite of maxillula of male.
6. Outer endite ,, ,, ,, ,,
7. Maxillipede of male.
8. 1st peræopod of female.
9. 7th ,, ,, ,,
10. 1st pleopod of male.
11. Uropod of male.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Porcellio (? *Agabiformis*) *rufobrunneus*, sp. n.

case of *Hemilepistus pectinatus,* B. L., a species also occurring in this region.

Porcellio (? *Agabiformis*) *rufobrunneus,* Sp. n. Plate V.

Locality—Amara : 13th Feb. 1918, Capt. W. E. Evans, 1 ♀ 4, ♂ specimens.

Description—Body oblong oval, about twice as long as broad, not very convex ; surface covered with numerous minute setæ, many small granulations, and obscurely tuberculate.

Head with the lateral lobes small and rounded, frontal lobe small, almost semicircular and a little raised in the middle, Epistome smooth, rather bulbously produced in the middle but without median tubercle. Marginal line clearly defined and a little raised. Eyes small with 15 ocelli.

Mesosome with coxal plates small and sloping downwards. 1st segment with the collar line double, the two lines being well separated and distinct throughout their length : hinder margins of the 1st, 2nd and 3rd segments without sinuosity and the posterior angles rounded, 4th with a little sinuosity and the hinder angles moderately sharp ; the remaining segment show progressively greater sinuosity and sharper angles.

Metasome with the pleural plates of the 3rd, 4th and 5th segments subtriangular.

Telson triangular, with the sides almost straight ; dorsal surface slightly if at all excavated.

Antennulæ with 1st joint a little longer than the 3rd, and 2nd about $\frac{1}{2}$ as long as 3rd. Apex with numerous fine " olfactory" setæ.

Antennæ reaching to the posterior margin of the 3rd segment ; 2nd, 3rd and 4th joints subequal, 2nd dilated, a little shorter than 3rd, 3rd and 4th equal in length, 5th as long as 3rd and 4th together. Flagellum almost as long as 5th joint of peduncle, biarticulate, with the 1st joint very slightly shorter than the 2nd.

Mandibles both with 4 brushes, one arising from the setose pad. In the type specimen the right mandible was unfortunately lost and the left showed only 3 brushes, one on the pad, but a fourth may have been broken off.

Maxillulæ : Inner endite with a well developed posterior spine and 2 moderately long brushes almost exactly equal in length. Outer endite with 4 major teeth—one of which is very small—and 6 minor—all sharp pointed and entire.

Maxillæ with the inner lobe smaller than the outer, and a small basal lobe.

Maxillipedes : Apex of the palp with numerous setæ ; middle region with two well developed spines and at the base of the outermost two small setæ ; basal joint with two spines. Endite with one spine and three teeth, the outer small and the other two large.

Peræopoda show a slight sexual dimorphism of the usual type.

Pleopoda : 1st two pairs only with pseudotracheæ. 1st pair in female small and do not meet in the middle line, exopodite with posterior edge almost straight and transverse and the inner roundly curved.

Uropoda with the basal joint notched externally : endopodite projecting about $\frac{1}{3}$rd of its length beyond the telson ; exopodite rather short, with a ridge on the outer margin.

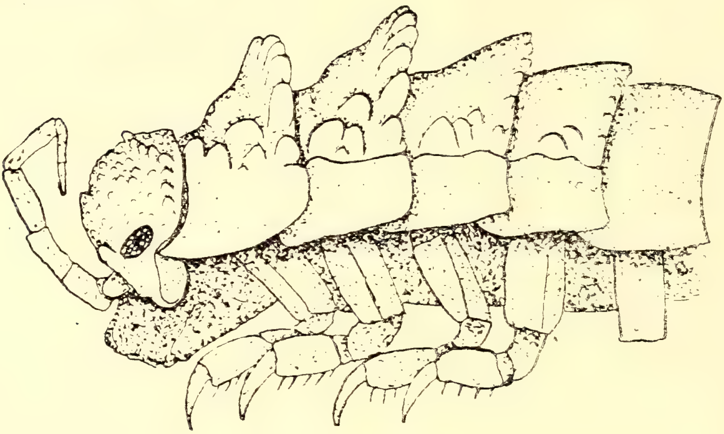
Colour—Light reddish brown, with small inconspicuous whitish markings legs and pleopoda white.

Length, 5-5 m.m. *Breadth,* 3 m.m.

Remarks—This species appears to be related to Budde Lund's sub-genus *Tura*, but differs in having 4 brushes on both mandibles and a distinct notch in the basal joint of the uropod. Verhoeff regards his sub-genus *Agabiformis* as including *Tura* and I am therefore placing this species with some hesitation in that sub-genus.

Hemilepistus pectinatus, B. L.
Budde Lund, 1885, p. 135.

Locality—Between Mosul and Korind 1921, Capt. H. E. Shortt, 12 ♀ 3 ♂ specimens.



Text Fig. 2.

This species is very like *H. Kulgii* (Brandt) and it seems probable that the male has been described as *H. Klugii* by Brandt, 1833, p. 179, and the female as *H. pectinatus* by Budde Lund. The *H. Klugii* material at my disposal has not however been sufficient for me to definitely establish the unity of the two species. As the female specimens from Mosul and Korind correspond with Budde Lund's description :—

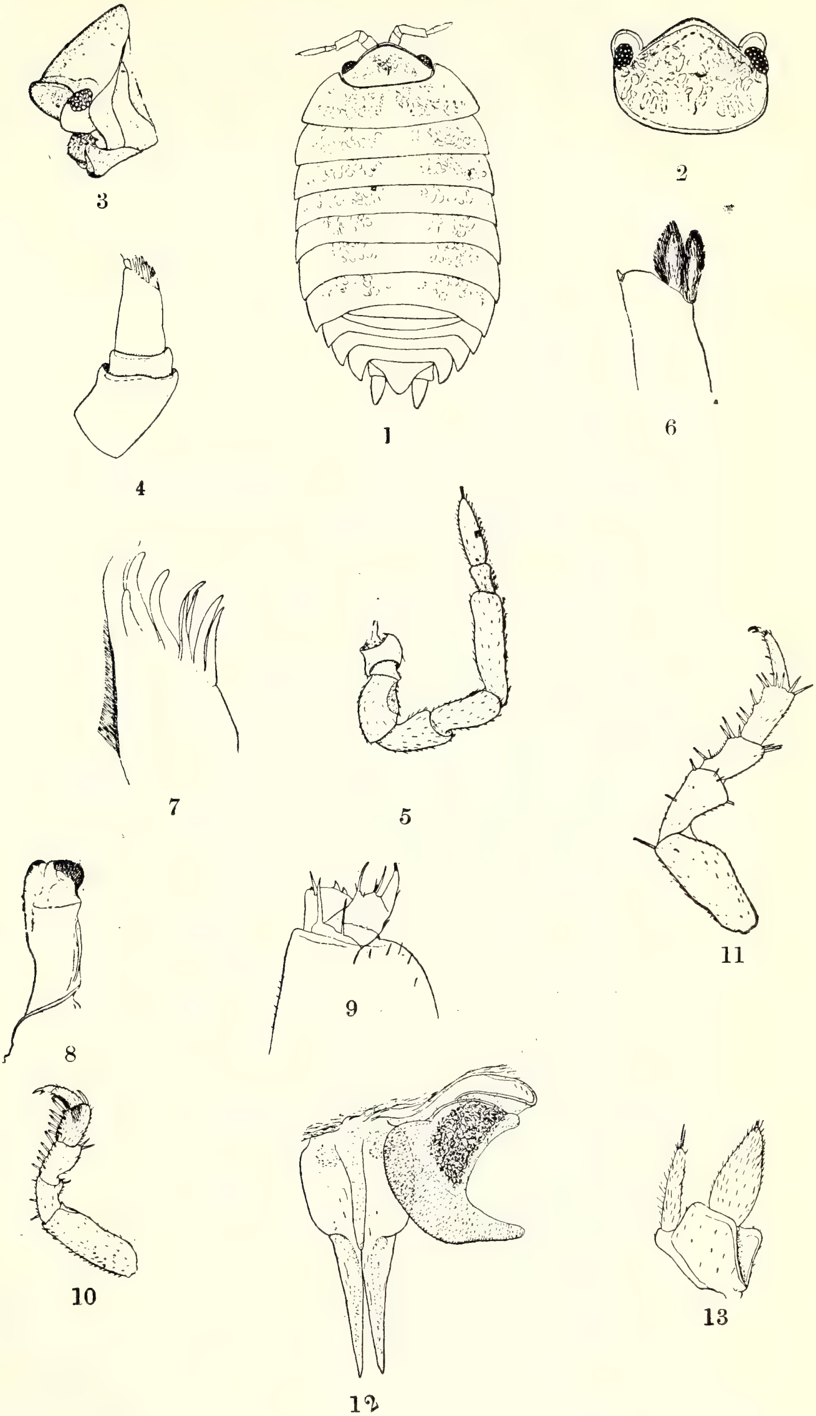
" Trunci epimera annulorum 2-3-4 sulco impresso a medio annuli discreta"—a feature of great interest and unknown in any other species of *Hemilepistus*,—there can be no doubt that they are the same species described by him as *H. pectinatus*, although there is no trace of such suture lines in the three male specimens and they appear to be identical with *H. Klugii*.

Leptotrichus politus, Sp.n. Plate VI.

Locality—Amara : Dec. 1918, Mr. R. G. Tame, 1 ♀ 7 ♂, specimens.

Description—Body oval, very convex, not more than twice as long as broad ; surface smooth and shining, with numerous small punctations and minute setæ which can only be observed with difficulty.

Head with lateral lobes small, rounded and sloping downwards, median lobes large, subtriangular, and smoothly rounded in the middle. Epistome bulbous, sloping smoothly downwards from the frontal lobe. Marginal line not very distinct, placed some small distance behind the margin of the median lobe, which has its edge rounded and continuous with the epistome. Just behind the marginal line is a shallow depression running across the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Leptotrichus politus. sp. n.

THE TERRESTRIAL OSOPODA OF MESOPOTAMIA AND THE SURROUNDING DISTRICTS.

EXPLANATION OF PLATE VI.

Leptotrichus politus, Sp. n.

1. Adult female.
2. Head of female from above.
3. ,, ,, ,, side view.
4. Antennule of female.
5. Antenna ,, ,,
6. Inner endite of maxillula of female.
7. Outer endite ,, ,, ,, ,,
8. Maxilla of female.
9. Maxillipede of female.
10. 1st peræopod of female.
11. 7th ,, ,, ,,
12. 1st pleopod of male.
13. Uropod of female.

head and to the back of the eyes, and marked off from the top of the head by an irregular broken line. Eyes with about 20 small ocelli.

Mesosome with coxal plates small and sloping downwards : 1st segment with the collar line single dorsally, the posterior margin without sinuosity and the hinder angles broadly rounded; 2nd with the posterior margin transverse, and the hinder angles a little rounded ; 3rd with a slight sinuosity and the angles sharper ; remaining segments showing progressively greater sinuosity and sharper angles.

Metasome with the pleural plates of the 3rd, 4th and 5th segments well developed and sub-triangular.

Telson triangular, with the sides slightly incurved and the apex rounded: dorsal surface not excavated, nearly or quite level.

Antennules, 1st and 3rd joints equal in length, 2nd about $\frac{1}{3}$rd the length of the 1st ; apex with about 16 " olfactory " setæ.

Antennæ short, reaching nearly to the posterior margin of the 1st segment of the mesosome ; 2nd, 3rd and 4th joints subequal, 2nd slightly the shortest, 5th a little shorter than the 3rd and 4th together. Flagellum biarticulate, 2nd joint a little more than twice as long as the 1st.

Mandibles : In the one female examined the right mandible was defective but had one brush on the setose pad, the left having 2 on the pad and 6 below. In one male the right had no brush on the pad and 4 below and the left 2 on the pad and 3 below, while in another the left had 2 on the pad and 4 below. The mandibles in this species would seem to vary not only with sex but in different individuals of the same age and sex.

Maxillulæ: Inner endite with small posterior spine and two short stout brushes of equal length. Outer endite with 4 major and 5 minor teeth, all sharp pointed and entire.

Maxillæ with the inner lobe wider than the outer, and without a basal lobe on the outer margin.

Maxillipedes with apex of the palp formed by a tuft of setæ ; middle region with 2 stout spines, each with 2 setæ at the base; basal joint with 2 spines; endite with one spine and three teeth, of which the innermost is very small.

Peræpooda stout and rather large, with numerous strong spines.

Pleopoda : 1st two pairs only with pseudotracheæ. 1st pair in the female well developed, more or less quadrangular, meeting at the median line. In the male the 1st pair have the exopodite crescentic in form.

Uropoda with the basal joint deeply notched externally ; endopodite projecting slightly beyond the telson ; exopodite short and stout, without bridge, and projecting about half its length beyond the apex of the telson.

Colour—Dark brown with scattered light yellow markings on the head and sides. Legs white.

Length, 8 m.m. *Breadth*, 4 m.m.

Porcellionides (=*Metaponorthus*) *litoralis*, (B. L.)

Budde Lund, 1885, p. 179.

Locality—Amara : 13th Feb. 1918, Capt. W. E. Evans, 9 specimens.

Porcellionides (=*Metaponorthus*) *swammerdami*, (Aud. and Savig.)

Audouin & Savigny : 1826, p. 289.

Localities—Amara : Capt. P. A. Buxton and Capt. W. E. Evans. Baghdad : Sept. 1917, Capt. P. A. Buxton, 2 specimens. Kizil Robat N. E. of Baghdad, Dec. 1918, Capt. W. E. Evans, 1 specimen.

This species was well represented in the collection. Most of the specimens were reddish yellow with darker markings on the margins but a few were lead grey.

Porcellionides (=*Metaponorthus*) *uniformis* (Koch.)

Koch, C. L., 1841.

Locality—Amara: 1918, Mr. R. G. Tame, 8 specimens.

I have accepted Budde Lund's identification of this species as Koch's description is insufficient and Budde Lund mentions in his M. S. that he has examined Koch's types. There is very little difference between this species and *P. pruinosus* (Brandt) and I feel doubtful whether they are distinct.

Porcellionides (=*Metaponorthus*) *pruinosus* (Brandt.)

Brandt, J. F., 1833, p. 19.

Locality.—Amara: Jan. 1918, Capt. P. A. Buxton, 2 damaged specimens.

I record this species with some hesitation as the condition of the specimens was very bad.

Philoscia elongata, Dollf.

Dollfus, Adrian, 1884.

Locality—Amara: Capts. C. L. Boulenger, W. E. Evans, P. A. Buxton, and Mr. R. G. Tame.

I have been unable to consult Dollfus' original paper, but accept Budde Lund's statement in his M. S. that *P. pulchella,* Budde Lund (1885), is a synonym of *P. elongata,* Dollf.

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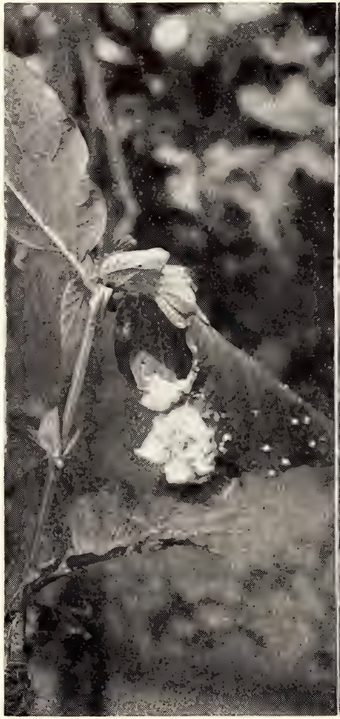
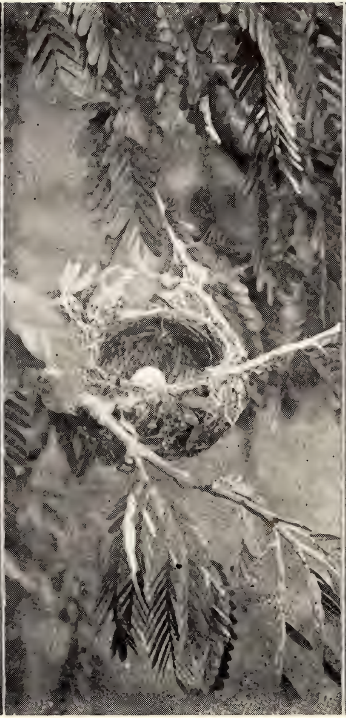
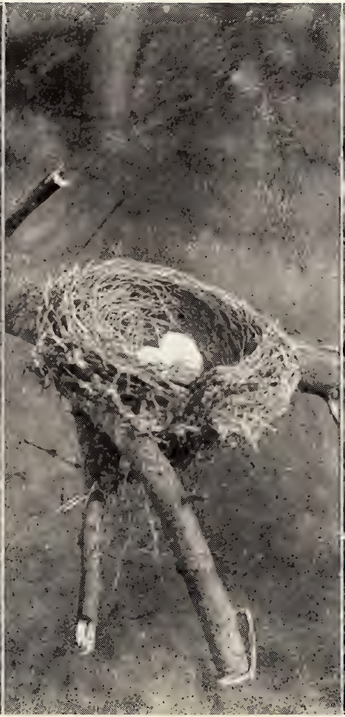


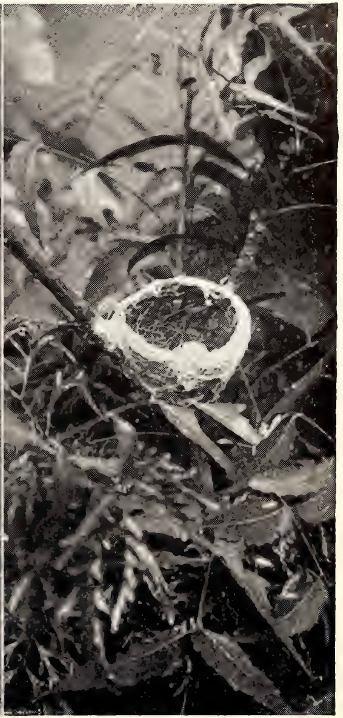
The nest of the Indian Tailor-bird.



Nest and egg of the Indian White-eye.



Nest and eggs of the Black Drongo.



Nest and eggs of the Common Iora.

A DESCRIPTION OF THE NESTS AND EGGS OF THE COMMON BIRDS OCCURRING IN THE PLAINS OF THE UNITED PROVINCES.

BY

E. H. N. GILL

PART II.

(*With* 2 *plates.*)

(*Continued from page* 1074 *of Vol. XXVIII.*)

Zosterops palpebrosa (226) .. .. The Indian White-eye.
Local name .. .. .. Unknown.
Anglo-Indian name .. .. .. Yellow Hammer.

These are insignificant birds, common in the Eastern and Western districts alike. They are gregarious to a certain extent, and in the winter are met with in small flocks. In the breeding season the parties seem to break up, and then they are seen, as a rule, only in couples. Domestic operations are commenced about April and continue, according to locality, till September. I have taken eggs in all these months.

The nest is a perfect work of art, and on account of its frailty is usually well concealed and difficult of location. Trees and bushes with overhanging branches and heavy foliage seem to be specially favoured; the nest being always suspended (never wedged in) from a slender fork or several twigs amidst an overhanging cluster of leaves; being, in fact, a perfect miniature of an Oriole's.

Quite recently I had the good fortune to find a nest at its very commencement. It was placed at the end of an overhanging branch (amidst a bunch of foliage) of a gigantic Tamarind tree in my compound. The nest was completed in 12 days, then there was an interval of 4 days, and then a single egg was laid each night, which were not incubated till the clutch of three was complete; and throughout this period I noticed only the one bird in the vicinity; probably the hen. The nest was about 8 feet from the ground, and my servants used to congregate under it during the day, and light fires under it at night, but without disturbing the bird in the least. In fact, she used to allow me to stand and watch her in the nest from a distance of a few feet. It was very amusing to watch her sitting perfectly still, bill pointing upwards, and without even the flicker of an eyelid; imagining no doubt that she was thus escaping observation. The nest was eventually discovered, and two of the eggs rifled by that outrageous dacoit *Dendrocitta rufa.* But I was in time to rescue the third, and reproduce a photograph of the nest.

The nest is constructed throughout of vegetable fibres, neatly and closely interwoven, and held in position by cobwebs and vegetable down; so frail as to be almost transparent. The egg-cavity is beautifully cup-shaped; lined, usually, with fine, black hairs, and the normal number of eggs is three. In shape they are, typically, rather longish ovals a good deal pointed towards the small end, and of a uniform pale blue colour throughout; a few eggs having a darker zone round the large end. A normal egg would measure about 0·62 by 0·46 inch.

Ægithina tiphia (243) .. .. The Common Iora.
Local name .. .. .. Shavbiga.
Anglo-Indian name .. .. .. Yellow-Bird.

I should think that this species occurs in almost every district in the Province; but where the accomplished collector would consider it common, the amateur would probably characterise it as rare. The fact of the matter is that on account of the bird's highly developed ventriloquistic attainments they are elusive creatures; so that unless one is an adept at distinguishing bird-notes they will quite easily escape observation. These notes, especially in the breeding season, are many and varied, with the high-pitched ones decidedly ventriloquistic; and even when located will not reveal the bird till after diligent search.

An interesting feature about the nidification of this species, of which I can find no mention elsewhere, is the plumage display indulged in by the males. The scene is usually enacted amidst heavy, green foliage, so that close observation is necessary to follow the procedure. In summer plumage the male is a goodly picture of black, white and gold, a colour scheme which is rendered much more picturesque during the period of display. While the hen, seemingly quite uninterested and oblivious of the close proximity of her lord and master, hops casually about the branches in search of food, the male fusses around and about her, stopping still at frequent intervals to expand his tail, droop his wings, and to raise his little head skywards in a stately pose calculated to give the best effect to his vivid colouring; and, incidentally, to attract the attention of his lady-love.

Each time the head is raised the throat swells and gives expression to a very faint, but clear, sweet, and musical whistle, somewhat prolonged. The scene changes suddenly, and in a paroxysm of excitement he flits from branch to branch to the accompaniment of a loud twittering and fluttering of wings, to rise suddenly into the air, and hurl himself, a ball of feathers, on to some favourite perch; the same mad proceeding being repeated again and again. Then his energies being expended he settles down to rest, and continues his placid hunt for insects, as though nothing had happened.

I have taken eggs of this species in both June and July, and last year a pair started to build a nest in my compound as late as the third week of August; but the heavy rain destroyed it before the eggs were laid. Almost any tree suits their purpose equally well, for I have taken their nests on Guava, Seesam, Ingadulcis, Mango, and other trees with comparative regularity; but never at any great height from the ground. They are composed of fine twigs and fibres plastered over with white cobwebs and gossamer threads, and are either wedged firmly into the fork of a branch, or on to the top of a horizontal one. They are circular in shape with the egg-cavity forming a perfect cup; the internal lining being of fine twigs closely interwoven. A few nests I have seen have been more or less cylindrical externally with the cup-shaped egg-cavity let in on top; while others have been the shape of an inverted cone.

The eggs, usually three in number, appear to be of two distinct types. In some the ground-colour varies from a greyish to a pinkish white marked with longitudinal blotches and streaks of a reddish brown shade; while in others the markings are a distinct chocolate. Between these two types intermediate varieties, varying in tone and character of the markings, occur not infrequently; some specimens presenting secondary markings of purple shades. In shape they are, typically, moderately broad ovals, slightly pointed towards one end; and measure about 0·69 by 0·55 inch.

Molpastes hæmorrhous (278) .. The Madras Red-vented Bulbul.
Local name .. .. .. Bulbul.
Anglo-Indian name .. .. The Common Bulbul.

This species is common throughout the Province, and is a familiar garden bird. The breeding season is from about March to August, though the bulk seem to breed in June and July, the nests being started shortly before the advent of the rains.

Being essentially arboreal in their habits, only occasionally descending to the ground, they do not seem to favour any particular kind of tree when selecting a site for their nests; nor is any importance attached to height; the nests being found as commonly at three feet as at thirty. Considerable importance, however, is attached to concealment; each nest being carefully hidden away amidst thick foliage. Sometimes they are fixed on to the top of a thick, horizontal branch, sometimes wedged firmly into the angle of a forked branch, and sometimes into the space formed by several bifurcating, vertical twigs.

The nests, internally, are all the same ; cup-shaped, and lined with fine twigs and grass-roots. They are coated externally with cobwebs and vegetable fibres; dry leaves, grass, and paper often being incorporated in the structure. Externally the nests conform to the shape of the position in which they are placed ; but, generally speaking, are of the shape of an orange cut in halves.

The number of eggs laid is invariably three. In shape they do not appear to vary to any appreciable extent; but are, typically, rather elongated ovals, slightly pointed towards one end. The ground-colour is a pinkish white ; while the markings, which are numerous and vary considerably in character, are composed of blotches, spots, specks, and smudges, of various shades of claret and reddish brown mixed together in every conceivable manner ; many specimens presenting conspicuous secondary markings of a purple shade, which seem to show from under the surface of the shell. A normal egg would measure about 0·89 by 0·65 inch.

Molpastes bengalensis (282) ..	The Bengal Red-vented Bulbul.
Local name	Kala Bulbul.
Anglo-Indian name	The Large Bulbul.

This species, so far as the plains are concerned, seems to have a curious distribution. But I write purely from personal observations. I have not seen this species at Allahabad, Cawnpore, or Benares ; though it is possible they occur there. It occurs quite commonly in Oudh, and the submontane tracks ; and very commonly in Ghazipur, where it breeds from April to July.

The nesting habits, and construction of the nests, are almost identical with those of *M. hæmorrhous* ; save that four eggs are often laid, as against the other's three. Also the birds seem to have a weakness for building on the same trees as the Black Drongo, with whom they live on quite good terms. In general shape and colouration the eggs resemble those of *M. hæmorrhous*, but taken as a whole they are slightly larger.

Otocompsa emeira (288) ..	The Bengal Red-whiskered Bulbul.
Local name	Kanera Bulbul.
Anglo-Indian name	Kankara Bulbul.

Outside Oudh I have never met with this species in any of the plains stations of the Province ; though it doubtless occurs in some of the districts in Rohilkhand. In Lucknow and Rae-Bareli it is quite common ; and yet uncommon in the adjoining districts of Sultanpur and Partabgarh. In the districts where it occurs it is a familiar and sprightly garden bird, and breeds from about March to June. The Horticultural Gardens at Lucknow used to be a favourite nesting ground ; while on the 15th April 1920 I took a nest with three eggs in a small croton plant on the verandah of the inspection house at Rae-Bareli.

The nests are rather typical of the species ; being somewhat solid and untidy structures of grass roots and vegetable fibres. Internally they present the usual cup-shaped appearance with the lining of fine twigs closely and neatly interwoven. The exterior is plastered over with a certain amount of cobweb which helps in keeping the materials in place ; dry leaves, bits of paper and sometimes rags, being incorporated. All the nests I have seen have been built in garden crotons and shrubbery.

This species, like the two already described, become frightfully excited at the approach of any stranger towards their nursery ; flitting from branch to branch and uttering loud, startling notes till the trespasser has departed to a safe distance. Consequently if one exercises a little patience, and plays the game of "hide the slipper," as it were, the "hot" and "cold" signs will be given by the birds themselves; the twittering becoming louder and louder, and the birds becoming more and more excited as one gets nearer the nest, which, by this method, is revealed in a very short time.

The number of eggs laid is invariably three, and they can, as a rule, be separated from those of *Molpastes* by the uniformity of the markings, consisting of numerous spots, specks, and minute blotches scattered profusely over the egg, as compared with the large irregular blotches of the others. Otherwise they are just the typical Bulbul's eggs with nothing particular or characteristic about them. In shape they are, typically, rather long ovals, somewhat pointed towards one end, and measure about 0·83 by 0·63 inch.

Sitta castaneiventris (321)	The Chestnut-bellied Nuthatch.
Local name	Unknown.
Anglo-Indian name	Creeper.

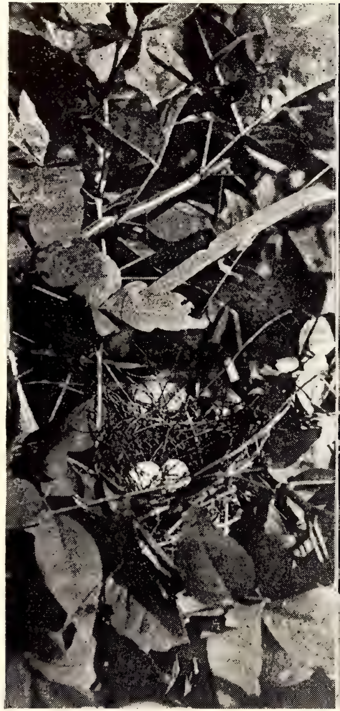
This is the only member of the family which seems to occur at all commonly in the plains of the Province, and is met with in most districts. Domestic operations are commenced, as a rule, in February; the bulk of the eggs being laid in March. All the nests I have examined in April have contained young, as has been the case with many others at the end of March; incubated eggs being of common occurrence.

The nest, unless one happens to hit up against it by accident, is one of the most difficult to find; so that the expedient of watching the birds has to be resorted to. I have found the nests on every conceivable kind of tree, though the Mango seems to be specially favoured. To begin with, a cavity or hole in some branch, large enough to contain the nursery, is selected, and the orifice built up with mud held in place with a salivery secretion together with a substance which looks like gum arabic. The masonry work often attains to a thickness of a couple of inches, and dries so hard as to necessitate the use of a hatchet when opening up the nest. An aperture, sufficiently large to allow one bird through, is left open. The hen then takes up her position inside the nest, which is invariably lined with bits of fine bark and dry leaves, lays her eggs, and never leaves them till they are hatched; after which she emerges to assist in feeding the young. During the period of incubation she is fed assiduously by the male who spends all the hours of daylight in frequent journeys to and from the nest.

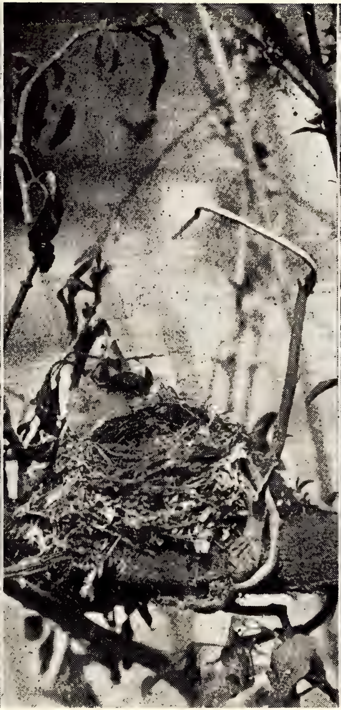
He is a cunning little beggar too, and guards the secret of his nursery with the greatest care. When bringing food for his mate he never alights directly on the nest, but on some other branch in the vicinity, from which position he takes a careful look around in order to satisfy himself that the coast is clear. If satisfied he approaches the nest in a series of quick runs, never straight, but round the branches in a spiral course. At the nest-hole he stops again to make assurance doubly sure, and if quite satisfied, he enters; if not, he scuttles away to await a more favourable opportunity. His entry into the nest is only for a few seconds, when he emerges again to hang head downwards at the aperture, waving his little head from side to side. Having satisfied himself that all is well, he flies off in search of more food.

In the vicinity of the nest this little bird can be most aggressive, and intolerant of the presence of other small species. Quite recently while watching a nest in a tree in my compound I saw a large Lizard with a flaming head crawl to the nest-hole and peep inside. Whether he was contemplating an entry or not I cannot say, but at that moment the male bird arrived with food, and so great was his wrath that he mobbed the Lizard to such an extent as to force it to release its hold, when it fell to the ground with a thud; the little bird following it in its descent to earth.

The same nest, if not disturbed, is used for three or four years in succession, presumably by the one pair of birds, for it would be difficult to state this definitely. The masonry work is invariably quite strong enough to defy the elements, and requires very little renovating when brought into use the next season; though the mud structure is often done without if the birds can find a crevice or hole with an aperture of suitably small size. I saw no less than three instances of this last March.

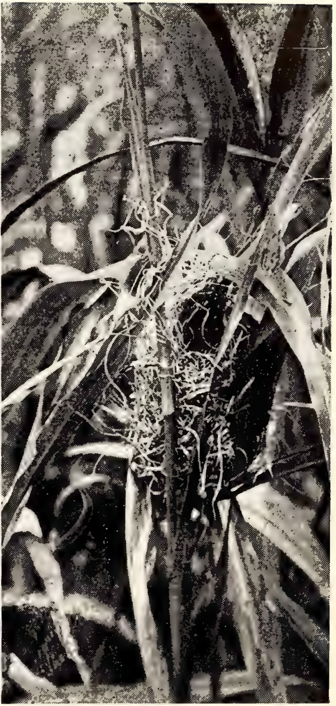


Nest and eggs of the Madras red-vented Bulbul.



Nest of the Bengal red-vented Bulbul.

Bengal red-whiskered Bulbul and nest.



Nest of the Indian Wren-warbler.

The number of eggs usually found in a nest is five. In shape they are slightly elongated ovals, only very slightly compressed towards one end. The ground-colour varies from a white to a very pale pink, and the markings, which vary considerably, consist normally of spots, specks, and minute blotches of a reddish shade scattered over the whole surface of the egg ; but generally more so towards the large end, where they have a tendency to form an irregular zone, or cap. A normal specimen would measure about 0·67 by 0·52 inch.

Dicrurus ater (327) .. .. The Black Drongo.
Local name .. .. .. Bojanga.
Anglo-Indian name .. .. King-Crow.

This is the one member of the family *Dicruridae* which breeds commonly in the plains of the Province ; consequently it will be the only species regarding which I shall make mention. Two or three other species are known to breed in the hilly, forest regions to the North of the Gonda district ; but I do not think they can be included amongst the common birds of the plains.

The Black Drongo is a common and familiar bird in most groves and gardens. A pleasant bird to watch as he indulges in ariel gyrations after the elusive insect; returning each time to some favourite perch to wait and watch for his next victim. An insolent bird, really, often darting past one's head to snap up an insect within a few inches of one's nose. Even cattle are forced to tolerate his presence, as he perches on their backs to catch the insects which they put up while grazing.

The Black Drongo is the one and only species of small bird which I have never seen attacked by a Shikra. In fact, he is capable of imitating the Shikra's call, and seems to be immune from its depredations.

In the breeding season these birds become most aggressive ; and are a plague to all feathered society in the vicinity of their nests; mobbing with deliberate intent any bird trespassing within their boundaries ; especially birds of prey, no matter how large. They are capable of soaring straight up into the air at a rapid pace which enables them to get above the object of their attention from which advantageous position they rain blows on the offending bird's head till it is absolutely routed. I have watched them treat Tawny Eagles, Buzzards, and Kites to as good a mobbing as they would administer to a Crow, and without the least fear, apparently, of any of them striking back.

Though intolerant of the presence of most birds near their nests, and of a nature most aggressive, they either have a weakness for, or are hoodwinked by, smaller species like Bulbuls, Doves and White-eyes, which often share the same tree while nesting. Either the aggressive instincts of the Drongo are not lost upon these other species, who look to the Drongo to drive away intending robbers; or the Drongo tolerates their presence on the principle that two eyes are better than one, and trusts to them to give the alarm when necessary. Certainly no other species, save the three mentioned, seem to be allowed this domestic liberty.

The Black Drongo breeds from about May to August. The nest is typical, and is always wedged into the angle of a forked branch. They are placed on large trees, usually high up, but I have also seen them at a distance of 8 feet from the ground. They are circular in shape, and made of coarse grass-roots and fine twigs, wrapped round and held in place with cobwebs. The egg-cavity is cup-shaped with the bottom comparatively frail and transparent ; the eggs being quite visible from below. A great deal of seemingly unnecessary attention is paid to the construction of the rim, which protudes above the surface of the branch to a height of an inch or more, and which is a characteristic feature of the nest. This is made so strongly that it may still be seen intact after the egg-cavity has deteriorated and fallen away.

The eggs, usually three in number, are of three distinct types ; a phenomenon which is probably influenced by the age and condition of the bird. In one the ground-colour is salmon pink, and the markings, consisting of spots and specks of reddish brown, are scattered over the egg towards the large end. In the second the ground-colour is paler and the markings much darker; while in the third the ground-colour is pure white without spot or blemish of any kind. Others again, except for their size, are hardly distinguishable from the eggs of the Common Oriole. In shape the eggs vary a good deal, but are, typically, rather long ovals, somewhat pointed towards one end; a normal specimen measuring about 1·01 by 0·75 inch.

Orthotomus sutorius (374)	The Indian Tailor-bird.
Local name	Phutki.
Anglo-Indian name	Tailor-bird.

This species is commonly distributed throughout the Province, but on account of its small size and skulking habits is more often heard than seen. Its call, heard to greater advantage during the breeding season, is clear, penetrating, metallic, and extraordinarily loud for such a small bird. It is met with only singly or in pairs, and is a familiar garden bird.

The period of nidification is from about June to September; most nests being started with the advent of the rains. The nests are typical, and comprise a soft, cup-shaped pad of cotton wool lined with horse-hair, placed inside the cavity formed by sewing the edges of two or more leaves together.

The nests are invariably close to the ground on account of the birds' partiality for large leaved plants, which, as a rule, never grow to any height. Quite frequently the nests almost touch the ground, but occasionally, when built amongst the leaves of Mango and Teak trees, are pretty high up.

The amount of labour entailed in sewing together the edges of more than one leaf must be colossal, and well worth a close study. But it falls to the lot of few to observe such a proceeding, so that most of us have to content ourselves with drawing conclusions from the completed nest. Quite recently, however, I had the good fortune to watch the construction of a single leaf nest; that is, a nest placed in the cavity formed by sewing together the edges of a single large leaf, and the procedure was vastly interesting.

The plant selected in this instance was a wild jungle growth bearing stiff, green leaves, about four inches by five in size, and it was to this plant that I saw a Tailor-bird fly one morning carrying a lump of cotton wool in her bill. I approached the spot very carefully but could see no sign of any nest. It was soon to be started. Selecting a leaf the bird gripped the stem firmly with its feet, and stretching forward along the middle line of the leaf attached the ball of wool to a point farthest away from the stem, and on the leaf's under surface; securing the ball in place by knotting the protruding strand on the upper surface of the leaf. Then by using the ball as a sort of centre of supplies the bird contrived to draw the edges of the leaf together by a system of strands of cotton wool rotating in all directions, drawn from the ball and knotted on the outside of the leaf in the most ingenious manner. When the edges of the farthest end were thus temporarily secured, another lump of cotton wool was attached at a point nearer the stem, and the same process repeated and continued till the strain exerted by the strands, each one being made shorter than the one before, was sufficient to hold the leaf edges in position while they could be permanently secured. Many of the strands were then removed and the nest proper constructed in the cavity thus formed.

The nest was completed in ten days after numerous disappointments and set-backs. Sometimes the tension of the leaf would be too great for the strand holding the edges in place, and the bird returning with more material would find that the leaf had sprung back to its original position, with numerous strands floating in the breeze. At other times the knots, not being large enough, would pull through, thereby ruining the labour of a whole day. But nothing daunted, this little feathered artisan stuck to its self-imposed task, and as often as a strand snapped, or a knot pulled through, so often were they renewed and strengthened. The bird's patience was inexhaustible, while the ingenuity it displayed in coping with its numerous difficulties was highly commendable.

In this species, the labour of nest construction seems to be undertaken almost exclusively by the female, as is also the work of incubation. But as soon as the young are hatched the male accepts his responsibilities, and shares in the strenuous labours of rearing the brood.

The eggs are up to five in number, and of two distinct types. In one the ground colouring is a greenish blue, and in the other it varies from white to salmon pink. The markings in both types are the same, and consist of spots, speckles, and irregular blotches of a reddish brown shade, scattered all over the egg, but more so towards the large end. Some eggs show only the spots and speckles and some only the blotches, but a normal egg shows all, and measures about 0·64 by 0·46 inch. In shape the eggs are typically long ovals, often tapering towards the small end. The shells are very thin and translucent with but little gloss.

Cisticola cursitans (381). The Rufous Fantail-Warbler.
Local name .. .. Ghas ka-phutki.
Anglo-Indian name .. Tic-tic.

This species is distributed throughout the Province in suitable localities; more abundantly in the vicinity of grass lands and rice cultivation. It is not in any sense a garden bird, but an inhabitant of open spaces usually removed from the vicinity of human habitations.

The males of this species exhibit the curious characteristic common to the Ashy-crowned Finch-Larks; a characteristic by which they may be readily recognised. They soar suddenly into the air at a rapid pace, rising and falling in rapid undulations, and accompanying each upward motion with a loud "tic", a sound which in the breeding season never fails to attract attention. They feed on or near the ground, and are seldom or never seen flitting about on the tops of bushes or grass clumps after the fashion of the Indian Wren Warblers. The soaring habit, however, is most peculiar. It seems to be more pronounced in the breeding season, and apart from fulfilling any useful object often reveals the position of a nest so well concealed that in ordinary circumstances would certainly have escaped observation.

To search for one of these nests is like looking for a needle in a haystack; but, if one has the time to spare, a little patience and perseverence will often solve the riddle. During the breeding season the ticking call-notes are uttered continuously; not only when soaring, but also while feeding; so that having located the sound, which will invariably be found to emanate from a patch of low grass or rice, it will be advisable for the observer to take up a position as near as possible to the sound without drawing unnecessary attention to himself.

Very soon the male will rise rapidly into the air till he gets to a height of thirty or forty feet. There he commences to rise and fall, uttering his call-notes the while, which are answered by his mate beneath. Suddenly he descends to earth in a rapid nose dive to a spot different from where he started. The observer should make a mental note of the place of descent and continue his watch.

The soaring will be repeated at comparatively short intervals; the bird descending in the same rapid manner, sometimes here, sometimes there, and perhaps frequently in the immediate vicinity of one particular spot. This spot should be carefully examined when a nest will probably be revealed. If this fails the other places of descent should be looked at, and if the nest is still not forthcoming, the birds are probably not breeding.

I mention this as a likely procedure (which I have tried myself) for locating the nest, and not as a hard and fast rule. In bird life there are idiosyncracies, and there is no accounting for behaviour in certain circumstances. But, from what

I have been able to observe, the females of this species seem to devote themselves to the work of nest construction, while the males spend a good deal of time in aërial gyrations which appear to the casual observer to be of no practical value whatsoever. It may be for the purpose of cheering the female in her labours or for keeping a careful watch from aloft; but if taken advantage of in the manner described it often reveals the presence of the nest.

The nests are wonderful structures and quite typical of the species. In shape they are mostly cylindrical, about 3 inches in depth with an egg-cavity of 1½ to 2 inches across, tapering up to an aperture about an inch in diameter, and they are never placed at more than a few inches from the ground. This little habitation is constructed thus :—To begin with a few grass or rice stems are wound round with cobwebs and gossamer threads until a frail and hollow cylinder about 3 inches in height is formed, and on account of the stems being less pliable towards the ground, the cylinder assumes a shape slightly broader below than above. This preliminary stage seems to be executed with the most consumate care, for on its exactitude the success of the nest would seem to depend. Once this cylinder has assumed the desired shape the work is hurried forward and the egg-cavity commenced by other stems being incorporated at the bottom and carefully welded together with cobwebs and fine vegetable fibres. At this juncture the nest is still very frail and is strengthened throughout by the incorporation of more stems and further coatings of cobwebs and vegetable fibres. Usually twigs growing overhead are drawn down to form a canopy over the nest in order to facilitate concealment, and the whole structure completed by the addition of an internal lining of soft, silky, vegetable down. In some cases the nests appear to be constructed throughout of cobwebs only, when they look very like large, spider's nests with the trap doors let in on top.

The breeding season seems to continue throughout the rains, though the bulk seem to have eggs in May, June, and July. The maximum complement of eggs is five, though one usually finds three or four, not infrequently only two. In shape they are rather short ovals slightly pointed towards one end, and the variation in colouration is pretty wide. The ground-colour is invariably white; sometimes pale pink, when fresh; and occasionally presenting a faint green tinge. The markings consist mostly of multitudinous specks and spots of a reddish brown shade scattered all over the egg. In some eggs the markings are scanty, in some profuse; while others present spots, specks, and minute blotches confined more or less to the large end and coalescing in places. A normal egg would measure about 0·59 by 0·46 inch.

Prinia socialis (464) .. ..The Ashy Wren-Warbler.
Local name .. ..Kala-phutki.
Anglo-Indian name .. .. ..Tom-tit.

This species breeds fairly commonly throughout the Province; its only claim to notoriety being due to the peculiarity that the one bird builds two totally different kinds of nests; a fact which has been, and still is, something in the nature of a puzzle to the ornithologist. Factors like climatic conditions, environment, and protective colouration, would seem to bear no significance whatsoever; for both types of nest occur, with comparative regularity, in similar localities. The eggs in each case are the same, the birds undoubtedly of the same species, but the reasons for the difference in nest construction still remain a mystery.

The birds are met with as frequently in gardens and shrubbery as in high grass, sugar-cane, and "*Bajra*" crops. Some, when embarking on the work of nidification, emulate the Indian Tailor-Bird, others the Indian Wren-Warbler. It may be argued that the architecture of the nest is influenced purely by environment to the extent that the bird uses material which is available in the immediate vicinity. This is plausible, but then how is one to account, as frequently happens, for the typical *P. inornata* nest in gardens without grass, and for the "Tailor-bird" design in some stray plant in the midst of a sea of high grass and cane cultivation. There does not seem to be any solution to the mystery, though theories may be easy to propound.

Domestic operations are commenced about May, and continue till the end of September; the bulk of nests containing eggs in July and August. The nests, as already mentioned, are of two distinct types. I have likened one to that of the Tailor-bird, and though this is true for purposes of general comparison, it is not true as to detail; for, to my mind at any rate, there is rather a distinct line of demarcation between the two.

The difference, as I see it, may be described thus:—The Tailor-bird first sews the leaves and then builds its nest therein, while the Ashy Wren-Warbler practically builds its nest first and then incorporates the leaves in the structure afterwards; purely, I take it, for purposes of stability and concealment. The cotton wool usually used by the former is rejected by the latter, and coir and vegetable fibres substituted; and these are the materials of which the nest is usually made. Never have I seen a nest of the Ashy Wren-Warbler contained in a single leaf, a common occurrence in the case of the Tailor-bird; from which we may conclude that for actual feats of sewing the latter species must be given best.

The other type of nest is almost identical with that of the Indian Wren-Warbler, which has been described further on.

The eggs, up to four in number, are typical and most conspicuous; and can never be mistaken for any other. They are reddish brown throughout without any markings whatsoever, though some specimens present a zone of a darker shade at the large end. In shape they are somewhat perfect ovals, and the shells brilliantly glossy. A normal egg would measure about 0·64 by 0·46 inch.

Prinia inornata (466) .. ..The Indian Wren-Warbler.
Local name. .. .. ..Phutki.
Anglo-Indian name .. ..Weaver-bird.

This species is very commonly distributed throughout the Province, but is essentially a bird of grass lands and open cultivation; seldom or ever occurring in gardens. The period of nidification is from about June to September, the bulk of nests being built in the long, "sarpat" grass so familiar along most railway embankments; the nests being commenced as soon as the rains set in and the grass becomes long and green. Sugarcane and *Bajra* crops often contain nests, but at rather a later period, for the plants do not attain to a suitable height till about August.

The nest is almost invariably quite typical; being an elegant and purse-like structure from 4 to 6 inches in height, with a small circular entrance near the top, attached to four or five stiff blades of grass, and composed of very fine strips of the same grass closely interwoven, rather after the fashion of the Indian Baya. It is devoid of any lining, and is composed both inside and out of the same material. The egg-cavity is from 1¼ to 2 inches in diameter and situated about four inches below the entrance.

Both birds appear to share in building the nest and rearing the young, but they would seem to incubate the eggs only at night, for never have I come across a bird in possession during the day. It may just have been pure coincidence, but on the other hand it may not; though it is certainly a departure from the normal.

Here again we meet with another oologistic puzzle on account of the eggs being of two distinct types; a peculiarity difficult of explanation. In one type the ground-colour varies from a bright greenish-blue to a dull green, and the other though rare, is a delicate pinkish white. The markings in both types are as intricate in their patterns as they are variable in their shades. These consist of bold blotches, spots, and smudges, of shades of chocolate and reddish brown scattered sometimes thinly, and sometimes profusely over the egg, and combined with intricate patterns in fine hair lines which usually encircle the large end and give the shell the appearance of being cracked; and which, incidentally, is a characteristic feature of the eggs.

It is difficult to give an adequate description of eggs of such complicated patterns, but that they are very beautiful goes without saying. To the oologist they are perfect pictures.

Five is the normal number of eggs laid, but as a great number are destroyed by lizards, larger birds, and vermin, one invariably finds only three or four. In shape the eggs vary a good deal, globular and moderately long oval varieties being common. Normally, however, they are perfect ovals often pointed towards one end, and measure about 0·61 by 0·45 inch.

Photo by R. E. Holmes, Peshawar

BETWEEN ROGHA KOT AND WANA.

NOTES ON A COLLECTION OF REPTILIA FROM WAZIRISTAN AND THE ADJOINING PORTION OF THE N. W. FRONTIER PROVINCE.

BY

Capt. C. M. Ingoldby, R.A.M.C., F.Z.S., F.R.G.S.

AND

Miss Joan B. Procter, F.Z.S.

(*With* 4 *Photos and a map**.)

INTRODUCTION BY CAPT. INGOLDBY.

The collection was got together during the operations of the Waziristan Field Force from December 1919 to March 1921. The following notes are primarily intended to serve as an indication to any members interested who may be stationed in or near the area covered.

While much work has been done in Sind and Baluchistan, where collections have been made by Murray, Blanford and Aitchison, and more recently by the Quetta Nat. Hist. Soc. and by Mr. J. E. B. Hotson, very little has been done except on birds in the country north-east of Baluchistan between Afghanistan and the Indus. Much of this country has been difficult of access except during the course of punitive expeditions which though of fairly frequent occurrence have commonly been of brief duration. From S. Waziristan a few specimens have been sent to the Society by Capt. W. B. Cotton, and Col. Wall has from time to time recorded snakes received from various officers from other parts of the province.

A spell of some months of comparative inactivity for my unit during the early part of the operations, spent on the L. of C., enabled me to train a squad of stretcher-bearers as collectors, and it is mainly to their exertions later on that this collection owes any claim it has to being fairly representative. I am indebted for a few interesting specimens to various officers, especially to Capt. J. M. Muirhead, at Kirghi, Capt. R. R. Thomson, M.C., R.A.M.C., at Kot Kai, and Capt. Russell, L.P.O., Ladha, through whose kindness I was enabled to get into touch with the Mahsuds of Kaniguram who brought, among other interesting specimens, the only examples I obtained of *Vipera lebetina.*

2. The country covered lies between 31·45—32·40 N. and 69·35—71·00 E. It consists of a strip of land running E. by S. to W. by N. about 20 miles broad and 90 miles long, lying between the Indus in the Dera Ismail Khan District and a line joining Wana and Kaniguram† near the Afghan border. The strip cuts across two well-defined types of terrain, the well-known flat semi-desert plain, a continuation of the Sind deserts which is the western side of the Indus basin floor, and the barren hilly country of Waziristan. The bulk of the collection was made in this latter area, mainly in or near the valleys of the TANK (TAK) ZAM, BADDAR TOI, SHAHUR R. and the WANA TOI.

3. Waziristan lies immediately to the north and north-east of the Zhob district of Baluchistan on a northerly sector of the eastern face of the Helmand Indus watershed. More generally, it occupies part of the eastern fringe of the plateau which includes Persia, Baluchistan, and the great part of the Afghanistan. It is ' border ' country in a zoological and geographical, as well as in a political sense. In the former senses it belongs more properly to Afghanistan than to British India. It comes, however, into the area prescribed by the F.B.I.

The country consists of a close and intricate series of hills reaching occasionally as high as 12,000 ft., intersected by boulder-strewn river beds, and of elevated stony plains. These latter are quite small for the most part, by far the largest reaches from Wana towards the Afghan border, and is about 10 miles broad by 23 miles long ; this has an average elevation of rather over 5,000 ft.

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* The map will be issued with a subsequent number.

† The capitals respectively of the 3 Wazirs and of the Mahsud.

The western boundary of the country is the Afghan border. The eastern boundary follows, roughly, the junction of the foothills with the Indus plain at an elevation of about 1,000 ft.

A few patches of alluvial soil in the bends of the rocky river beds, on the plains, and in the wider valleys permit of cultivation. Above 4,000 ft. the hills are increasingly but sparsely forested, chiefly with holly oak (*Quercus ilex*) up to the pine level, which is said to be about 8,000 ft. here. Below 4,000 ft., they support a few scattered bushes of acacia, wild olive, ' sloe ' ' bir, ' with patches of mazri palm, tussocks of coarse grass and desert herbs. In some of the wider valleys these occur in considerable profusion. The climate is dry. The heat in summer is excessive in all parts below about 5,000 ft. In winter the diurnal range of temperature is great. Rainfall is fitful and scanty throughout the area. Falls of snow below 5,000 ft. are rare. Thunderstorms during late spring and summer are occasionally of sufficient violence to cause serious spates in the river beds. The most interesting feature of the climate is the occurrence throughout the year of frequent and severe dust storms, which sometimes are of many hours duration. These seem to occur with the greatest frequency and violence between the levels of about 3,000 to 5,000 ft.

The difference in the character of the forested country above 5,000 ft. from that of the dry scorched hill sides below that level is strongly marked ; it is reflected in the character not only of the flora but of the fauna of the two areas.

The following lists are forms more or less characteristic of their respective areas ; those given for one area either were not found or are rare in the other area :—

Below 4,000 *ft.*	*Above* 5,000 *ft.*
MAMMALIA.	
Paraëchinus blanfordi.	Hemiëchinus megalotis.
Herpestes edwardesi feruginous	Paraëchinus amir.
Grypomys gleadowi.	Mustela foina.
Dipodilus indus.	Meriones swinhœi.
Meriones hurrianæ.	Cricetulus sp.
Tatera sherrini.	
REPTILIA.	
Ophidia.	
Eryx jaculus.	Zamenis mucosus.
Zamenis ventrimaculatus.	,, rhodorachis var ladacensis.
Psammophis schokari.	Vipera lebetina.
,, leithii.	
Echis carinatus.	
Lacertilia.	
Agama isolepis.	Eublepharis macularius.
,, rubrigularis.	Agama nupta.
Uromastix hardwickii.	,, lirata.
Acanthodactylus cantoris.	,, caucasica.
Eremias guttulata.	Calotes versicolor.
	Eremias velox.

BATRACHIA.[†]

Rana tigrina.	Rana sternosignata.
,, strachani.	,, limnocharis.
Bufo stomaticus.	

On the wooded hill sides and cultivated areas above 5,000 ft. snakes are locally pretty common, as in the neighbourhood of KANIGURAM, but on the whole they are scarce, in notable contrast to lizards and frogs which abound (the latter somewhat surprisingly in view of the nature of the country) throughout the whole tract.

On the whole the collection is not of great interest. Of Lacertilia one new species was obtained, described in this paper by Miss Procter, and in several cases the previously known range of species already recorded from Persia or Baluchistan is slightly extended. In only one case (*Mabuia dissimilis*) is the range extended westwards. Most of the lizards common in the western Himalayas do not occur in these hills.

The collection is certainly not complete. Many species are very local; those found in one valley often differ strikingly from those of an adjacent valley. At no place was it possible for military reasons to reach the pine level. The absence among other forms likely to occur of *Phrynocephalus* and *Ophiomous* will be noticed. I was disappointed not to find more of the desert geckos; neither *Stenodactylus* nor *Alsophylax* was obtained, though both are said to occur in the Zhob.

The Iranian character of the lists is well shown by the Lacertilia. Save the one not hitherto described, only one (*Mabuia dissimilis*) has not previously so far as I am aware been recorded from the Plateau. Of the 24 species in the collection, two only can be regarded as characteristically oriental (*Calotes versicolor* and *Varanus bengalensis*).

I have received much help with the identifications from the officials of the Society, and from Miss J. Procter of the British Museum. My thanks are due to them for this, especially to Messrs. R. A. Spence and S. H. Prater for their frequent and interesting letters at a time of great pressure of work in the Society's Office and to Miss Procter who has most kindly worked through the whole of the material of the Lacertilia in the collection and whose notes on this section add, I need not say, enormously to the value and interest of the paper.

I am indebted to R. S. Holmes, photographer, for permission to use some of his beautiful photographs of Waziristan.

In conclusion I should like to appeal on behalf of the Society's Museum for lizards. As long ago as 1905 Gleadow, in a most interesting article (Vol. XVI, No. 4, p. 723) in this Journal, made a similar appeal, giving a list of the specimens then in the museum and a very long list of "wants". The disproportion between those lists has not been since reduced as much as might have been hoped. The snake collection, thanks largely to the influence of Col. Wall, may claim to be representative. Lizards still hang fire. The reason may perhaps be found in part in the haunting and memorable lines—

> " The beast I'm sure will well repay
> Your kind and tender care
> At least so lonely people say
> Who keep a frog, and by the way
> They are extremely rare."

Or words to that effect.

For frog read lizard. If members will turn up the article referred to above I am sure they will be moved, if not to keep lizards at once as pets, at least to bottle some and send them in. Few creatures are easier to collect. None involve less trouble in preserving. Gleadow's description of the Spiny-tailed lizard, while losing much of its point in absence of the illustration which accompanies the original, may apply to all the tribe. "They are lovely, most interesting and surprisingly tame creatures."

[†] For the identification of these I am indebted to Prof. Narayan Rao.

Indus Plain.		South Waziristan.			
		Tank Zam & Baddar Toi.		Shahur R. & Wana Toi.	
	Feet.		Feet.		Feet.
Dera Ismail Khan .	600	Kirghi	1.600	Shahur Tangi ..	2,500
Tank	850	Jandola ..	2,270	Haidari Kach ..	3,000
Kaur Bridge ..	1,000	Kot Kai ..	3,000	Sarwekai ..	3,600
Murtaza	1,000	Sora Rogha ..	4,000	Karab Kot ..	3,900
		Ladha	5,500	Wana	5,000
		Kaniguram ..	6,000		

CHELONIA—By Capt. C. M. Ingoldby.

Trionychidæ.

(1) *Trionyx gangeticus.* Indus.
Common in the vicinity in the D. I. K.

(2) *Emyda granosa* .. Near Tank.
Met with in the irrigation channels into which the Tank Zam splits up on reaching the plain.

Testudinæ.

(3) *Testudo horsfieldi.*
(4) *Testudo hardwickii.*
Found in association on the Wana plain near the surrounding hills. Said to be abundant on the Marwatai hills. The former is by far the commoner. Examples of both were previously sent to the Society by Cotton (J.B.N.H.S. Vol. XXV., p. 519, Vol. XXVI, p. 314).

(5) *Kachuga smithii* ... Indus.
Abundant. The third vertebral which is quadrilateral or sub-quadrilateral in adult specimens is a clean cut pentagon in the young. It is necessary to bear this in mind when using Boulenger's key to the genus in the F.B.I.

LACERTILIA.—By Miss Procter.

The lizards of Capt. Ingoldby's collection are interesting from two points of view: geographic distribution, and range of variation. They also include a new species of Gecko which I have much pleasure in naming after its discoverer. In most cases large series of specimens were caught, both adult and young, and the individual variation is often great, that occurring in *Eumeces schneideri* being of particular interest. Other species which deserve special mention on account of rarity are *Agamura persica* and *Ablepharus grayanus*.

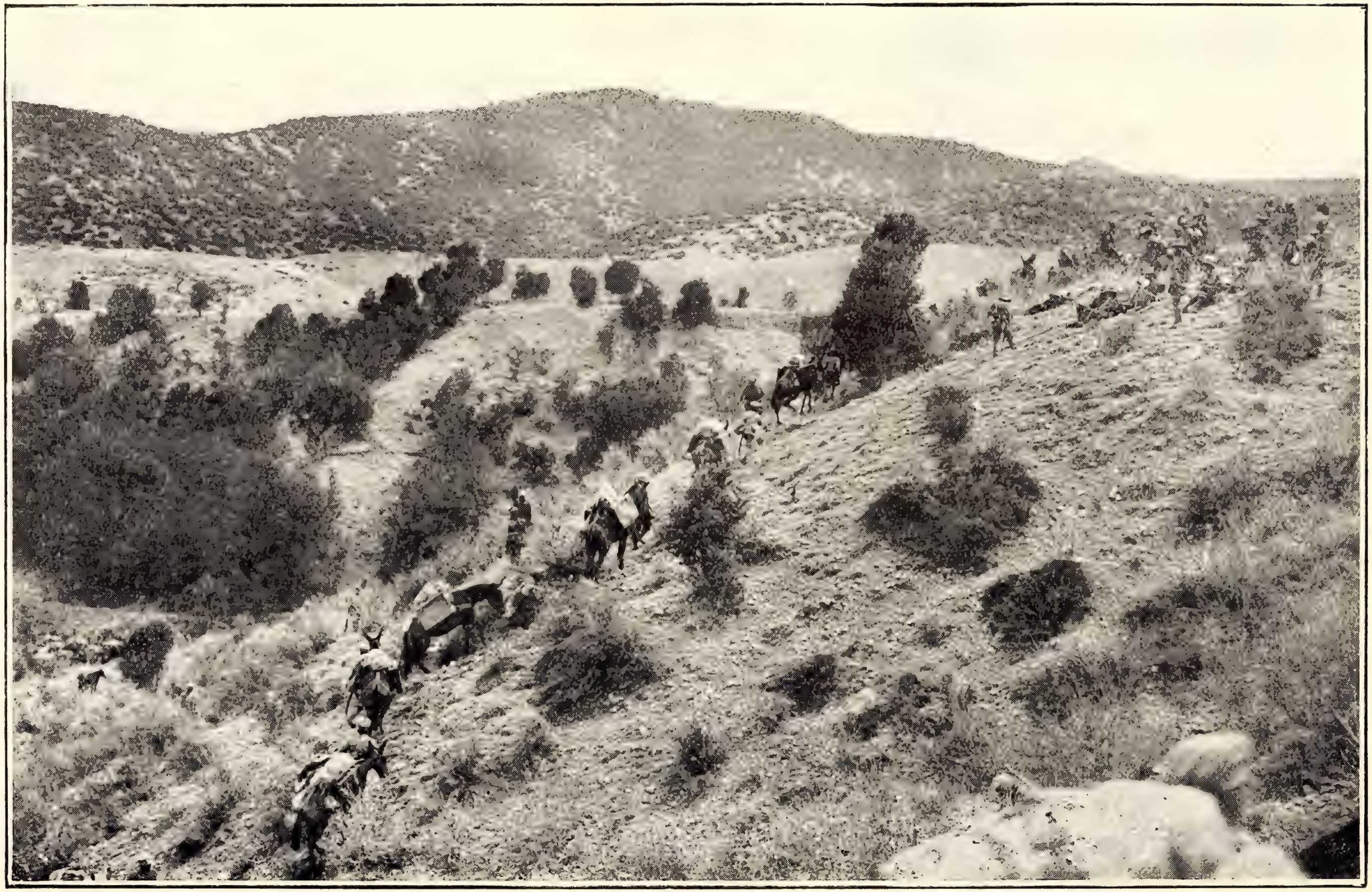


Photo by R. E. Holmes, Peshawar.

ILEX FOREST NEAR LADHA.

GECKONIDÆ.

1. *Gymnodactylus scaber* Rüpp.

Specimens : 13 ; adult and half-grown.

Localities : Dera Ismail Khan, Kaur Bridge, Tank, Kirghi, Sarwekai, Ladha, Wana.

Note.—A common desert gecko throughout the tract. A house gecko in Tank —C.M.I.

Distribution : Egypt to Afghanistan and Sind.

2. *Gymnodactylus ingoldbyi*, sp. n.

Specimens 6, ♂♂, 6 ♀♀, 2 half-grown, and young.

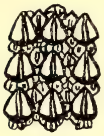
Localities : Ladha 5. Sarwekai 1, S. Waziristan (exact locality unmarked) 10.

Type : an adult ♂ from Ladha ; British Museum Reg. No. 21. 3.21.1, Collector's number 63.

Description : *Habit.* Small ; somewhat depressed. Head ovoid ; snout roundly pointed, longer than distance between eye and ear ; forehead very slightly concave, ear opening small, vertical ; eye moderate. Limbs moderate ; hind-limb reaching the shoulder or the constriction of the neck ; fore-limb reaching slightly beyond tip of snout ; digits very slender. Tail depressed, oval in section.

Lepidosis : Rostral about twice as broad as deep, with a median cleft above ; nostril pierced between rostral, first labial, and two or three very small nasals ; 9 or 10 supralabials, 9 or 10 infralabials ; mental subtriangular usually equialteral ; two pairs of large chin-shields and one or two smaller pairs, the first large pair in contact behind the mental.

Snout covered with convex rounded granules, moderate in size, becoming irregular in size posteriorly ; occipital region covered with irregular convex granules intermixed with small tubercles. About 12 longitudinal series of moderate subtriangular keeled tubercles on the back, about the size of the ear opening when expanded ; the series of tubercles separated from each other, transversely and longitudinally by one* series of small, keeled tubercles, highly irregular in size and shape (*vide* text-fig.). Upper surfaces of thigh and tibia covered with small keeled tubercles, intermixed with a few large ones ; fore-limbs covered with imbricate keeled scales. Subgular granules minute, ventrals very small, hexagonal, imbricate, in about 40 longitudinal series ; lateral fold feeble. Tail with three paired longitudinal series of large trihedral mucronate tubercles on upper surfaces, arranged in transverse bands, two or three transverse series of small similar tubercles between each band. Smooth imbricate subcaudals, with a somewhat enlarged paired median series, which are often indistinguishable beneath the first three or four annuli.


×5

Male with six præanal pores in a curved transverse series.

Coloration : Adults brown or greyish brown, with indistinct dark spots arranged in curved transverse series as in *G. kachhensis* or *G. scaber* ; young with strongly marked, alternating, light and dark curved transverse bands ; tail annulate.

This species is nearest to *G. kachhensis* which has similar subcaudals and præanal pores, but which differs in having longer legs, larger ventrals, and fine granular homogeneous lepidosis between the large dorsal tubercles.

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* Sometimes two in places.

In *G. ingoldbyi* the ventrals are smaller and more numerous than in any other species of the *scaber* group. There are about forty series counting from the lateral fold ; about fifty counting from the outer row of dorsals tubercles.

3. *Agamura persica* Dum
   2 specimens.
   Localities : Wana, Karab Kot.
   Note :—Each was found on a stony plain, in the Wana vicinity. As noted above this extends the range.—C. M. I.

As foreshadowed by Professor Boulenger in his report on Dr. Aitchinson's specimens from the Afghan Border (Trans. Linn. Society., 1889, V. 3), *Agamora cruralis* and *A. persica* can no longer be separated. Specimens in the British Museum collection added since that date (*e.g.*, No. 1912. 3. 26·12.) show complete intergrating in all the points on which the two were originally separated by Blanford (Zoology, E. Persia, 1876, pp. 358 and 359). The creature thus shows a very remarkable range of variation not only in lepidosis but in form. Thus the length of the hind limb (grown to heel) compared with the length from snout to vent varies from 47 % to 61 % and there is most striking difference in the shape and size of the head compared with the trunk in different specimens. There seems to be some relation between distribution and their morphological differences, the short limbed small headed forms, Blanford's *A. persica*, occurring usually at a great height (over 8,000) and long limbed big headed forms commonly being found at about 1,000 ft. This relation, however, is not invariable. The above mentioned specimens from Waziristan, typically long limbed and big headed, were obtained at over 5,000 ft. A specimen of the other variety was obtained at Kharan, Baluchistan, by Cumming.

Distribution : Baluchistan, Waziristan, and S. E. Persia.

4. *Hemidactylus flaviviridis* Rüpp.
   1 specimen, *Locality* : D.I.K.
   Distribution : Red Sea to India.

5. *Hemidactylus persicus* Anders.
   6 specimens.
   Localities : Ladha, D.I.K., and Kaur Bridge.
   Rare as a desert gecko on the Indus Plain.
   An occasional house gecko in D.I.K.—C.M.I.

EUBLEPAIRDÆ.

6. *Eublepharis macularius* Blyth.
   30 specimens.
   Localities : Kaur Bridge (1), Manzai (1), Ladha (12), Wana (16).
   Note :—Not uncommon on the Raghzas (patches of flat ground raised high above the river bed) near Ladha, and on the Wana plain. Usually found in the bases of old standing piles of stones. I only found two below 2,000 ft. One specimen captured voided Scybala containing the harder portions of crickets. I found no traces of vegetable matter in the few stomach contents examined. It is difficult to understand how a relatively slow moving creature, showing itself in captivity so thirsty and wasting rapidly if deprived of water, thrives on the desert at a distance of over a mile from the nearest water available. I examined three specimens of the young of this species ; the first of which was presented to me by Capt. T. M.

Morton, 4-3rd Gurkha Rifles. These exhibit typical "warning coloration," being broadly banded on the body with black and vivid yellow alternately. Traces of yellow remain throughout life in the appearance of faint powdering over the light parts of the body.—C.M.I.

Distribution : N. W. India; Persia and Baluchistan, Mesopotamia and Transcaucasia.

AGAMIDÆ.

7. *Calotes versicolor* Daud.

20 specimens.

Localities : Ladha (14), Wana (6).

Note :—Found at and above 5,000 ft. I found it on three occasions on stony hillsides at a very considerable distance from the nearest bush or tree. The largest examined was only eight inches, total length (sv. 2.4 T 5.6)—C.M.I.

Distribution : Afghanistan and Baluchistan to Southern China.

8. *Agama isolepis* Blgr.

29 specimens.

Localities : Kaur Bridge (15), Kulachi (2), Wana (12).

Notes :—Abundant on the Indus plain in the neighbourhood of the foothills on the Wana plain. I do not recall having seen notice published of the considerable extent to which, as in some other *Agamas*, the female shares with the male the capacity for a vivid blue ' flushing ' of throat and flanks under excitement.—C.M.I.

The female and two young have a vertebral series of light pinkish lozenge-shaped spots.

Distribution : Egypt to Sind, Waziristan is probably the most northerly point at which this species occurs.

9. *Agama rubrigularis* Blanf.

5 specimens.

Localities : Kaur Bridge (1), Manzai (3), (1 unlabelled).

Notes :—Found along the low foothills up to about 1,500 ft. It is most commonly seen about sunset. I have never met it in the hot weather during the heat of the day.—C.M.I.

The dorsal scales of these specimens are distinctly keeled, particularly on one male, which resembles many specimens of *Agama persica* in this particular ; in fact since in many of the latter the dorsal scales are not very strongly keeled, the two species can no longer be separated by this character.

Distribution : Persia, Baluchistan, Sind.

Waziristan is probably the northern boundary of its range of distribution.

10. *Agama nupta* De Fil.

4 specimens.

Localities : Shahur Tangi (1), Rogha Kot (1), Wana (2).

Note :—Like the two following species, this is extremely local in its distribution. I never saw it in the valley of the Tank Zam. In two of the three specimens obtained the majority of the caudal segments in the proximal third of the tail were composed of two whorls of scales only.—C.M.I.

Distribution : Mesopotamia, Persia, Baluchistan. Waziristan is probably the Eastern limit of its range.

11. *A. lirata* Blanf.

5 specimens.

Locality : Ladha.

Note :—Found on the wooded rocky hillsides in the neighbourhood of Ladha and Kaniguram, sometimes together with, but far less commonly than the following form. The stomach contents in each case examined were purely vegetable. One stomach contained, amongst much other vegetable matter, three berries.—C.M.I.

The enlarged dorsal scales of these specimens are practically smooth ; in transverse section they would be shaped, but have no distinct keel ; although this is unusual, there are similar specimens in the collection of the British Museum.

Distribution : Sind and Baluchistan. A new record for Waziristan.

12. *Agama caucasica* Eichw.

7 specimens.

Locality : Ladha.

Notes :—Abundant but very local in the neighbourhood of Ladha.—C.M.I.

These specimens have 180 scales round the body, as against 150 to 160 which is the range given for this species in the "Fauna of British India." In this respect they agree with two specimens collected by Capt. Hotson in Baluchistan, and presented to the British Museum by the Society. Possibly further collecting may produce specimens completely linking up this species with a *A. microlepis*, which resembles it in all other characters.

Distribution : Caucasus to Persia, Baluchistan, Waziristan and Afghanistan.

13. *Uromastix hardwickii* Gray.

Locality : Kaur Bridge.

Note : — A large colony in the vicinity of Kaur Bridge. Said to be common around Bannu. The largest I measured (♀) had a total length of 16¼″—C.M.I.

Distribution : N.-W. India to Baluchistan.

VARANIDÆ.

14. *Varanus griseus* Daud.

4 specimens.

Locality : Kaur Bridge.

Distribution : N.-W. India to Caspian Sea and N. Africa.

15. *Varanus bengalensis* Daud.

6 specimens.

Localities : D. I. K. (1), Kaur Bridge (5), also seen at Ladha and Wana. Common throughout the tract.—C.M.I.

Distribution : India, Ceylon, Burma, Assam. Waziristan is probably the North-Western limit of its range.

LACERTIDÆ.

16. *Acanthodactylus cantoris* Gthr.

4 specimens.

Localities : Kaur Bridge, Kulachi.

Note :—Nothing remarkable. The commonest lizard of the Indus plain, I did not find it above 1,000 ft.—C.M.I.

Photo by R. E. Holmes, Peshawar.

CONVOYS FROM WANA.

The young of this species are strikingly marked with the primitive pattern of seven longitudinal black stripes, alternating with six white ones.

Distribution : N.-W. India to Persia.

17. *Ophiops jerdoni* Blyth.

15 specimens.

Localities : Murtaza (3), Ladha (6), Wana-Sarwekai (5), Haidari Kach (1).

Notes :—Met with occasionally whenever there was open ground from 1,000 ft. upwards.—C.M.I.

An interesting series, including three extremely young specimens.

Distribution : N.-W. India and C. India.

18. *Eremias guttulata* Licht.

Many specimens.

Localities : Kaur Bridge, Jandola Wana. Most individuals not labelled.

Notes :—Extremely common almost throughout the tract from the Tank neighbourhood upwards. I did not find it in the upper Tank Zam valley.

A considerable number of males exhibited very marked plumbeous staining of the throat and chin, extending as irridescence over the belly. In only two cases of a large series was the throat yellow. Both were males.—C.M.I.

These lizards show considerable range of variation in the size and shape of the occipital shield.

Distribution : North Africa, South-Western Asia from Arabia to Afghanistan and Sind. Waziristan is probably the most Easterly point recorded.

19. *Eremias velox* Pallas.

Many specimens.

Localities : Ladha, Wana. Many specimens unlabelled.

Notes :—Common at 5,000 ft. and upwards.

All the young obtained had blue tails. I never saw the pink tail described in the F. B. I., Bombay, 1894.—C.M.I.

A series of 45 specimens show great range of variation in rugosity of the head shields, size of the interpareital, and in markings.

Distribution : S. Russia, Transcaucasia, Turkestan, Persia, Baluchistan and Afghanistan. Waziristan is the Eastern limit of its range.

20. *Eremias fasciata* Blanf.

1 specimen.

Locality : Wana.

Note :—The scale rows, as nearly as I could make out with a poor lens, were 54. In all other respects it agrees well with descriptions by Blanford (Zool. E. Persia) and Bouleng. (F. B. I.).—C.M.I.

Distribution : S. Persia, Baluchistan. Waziristan is probably the N.-E. limit of its range.

SCINCIDÆ.

21. *Mabuia dissimilis* Hallow.

5 specimens.

Locality : Haidari Kach.

Notes :—Very local. I only found it in one place, where it was occupying the burrow of mole rats near the river bed.—C.M.I.

These specimens are of considerable interest. In two specimens the dorsals are strongly bicarinate as is usual in this species; the 3 other specimens have only the middle 3 or 5 rows bicarinate, all other dorsals being tricarinate, the middle keel the weakest, but quite distinct; the strongly tricarinate scales usually confined to the nuchal, and lateral areas continue far behind the shoulders.

This species resembles *M. septemtœniata* in the head-shields, and *M. vittata* in colour, markings, and general appearance. The 5 specimens in question have the characteristic greenish white, black edged vertebral and lateral stripes, with greenish white spots on the sides.

One female contains about 6 eggs.

Distribution: Western Hïmalayas, plains of N. India. Not previously recorded from Waziristan.

22. *Ablepharus grayanus* Stol.

2 very young specimens.

Locality: Ladha.

Note:—This rare skink differs from other species of the genus in having the tympanum hidden. Both specimens are well marked, the smaller was evidently newly hatched.

Distribution: Cutch, Sind, Kurrachee. A new record for Waziristan.

23. *Eumeces scutatus* Theob.

27 specimens.

Localities: Kaur Bridge (7), Ladha (8), Wana (12).

Note:—Found in greatest abundance as the Afghan border was approached. Usually obtained from the burrows of *Tatera indica* in the sandy patches, which occur round the roots of bushes on the otherwise stony plain bordering the foothills, or from those of *Gunomys* sp.* in the cultivated areas at higher elevations.

Adult specimens from the ilex level (Ladha-Kaniguran) were noticeably darker and more heavily striped than specimens of equal size from the Indus or Wana plains.

The vivid deep saffron of the belly disappears in spirit in 3 or 4 days.—C.M.I.

Distribution: E. Persia, Afghanistan (?), N.-W. India. A new record for Waziristan.

24. *Eumeces schneideri* Daud.

30 specimens.

Localities: Kirghi (1), Jandola (2), Kot Kai (1), Sarwekai (1), Wana (25).

Notes:—Of 23 specimens examined, 3 have 30 scales around the mid-body; one has 29; 2 have 27 and one has 26. The remaining have 28.

The heads, in females, frequently have a somewhat bleached appearance, but in no case show the greenish yellow colour of the heads of adult and half grown males.

Found on all open ground covered between 1,500 and 5,000 ft. On Wana plain, where this skink is very abundant, I examined a considerable number of burrows. All were of the type described by Blanford (Zool. E. Persia, 1876, p. 388), *i.e.*, bending at a right angle a few inches from the surface. The burrows were usually about 18 inches to 2 feet in length, commonly opening into the lip of a depression and running horizontally, and occasionally showing a second right angle bend.

At the time most of the burrows were examined (February) the lizards were hibernating. The burrow was often found to be occupied by *Eremias velox* or *Eremias guttulata* in addition to *Eumeces schneideri.*

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* *Note.*—The mole rat (*Gunomys* sp.) was invariably found in the cultivated patches.

The only small mammal I could discover in burrows in that part of the plain (*Meriones hurrianæ*) was of rare occurrence, and his burrow was of different length and disposition. It seems very probable that the burrows are made by the skink.—C.M.I.

This splendid series widens the known range of variation considerably, in fact if one or two specimens alone had been submitted to me for examination I should have unhesitatingly founded a new sub-species.

In the typical form the first upper labial is in contact with the nasal only; this character was evidently considered to be specifically stable by Mr. Boulenger, as he makes use of it in the key to the genus in his Catalogue of Lizards. In several of the specimens of the present collection however, the first upper labial is in contact, corner to corner with the anterior loreal, and in five others the two shields are more broadly in contact. Capt. Ingoldby has already mentioned the variation in the number of scales round the body.

In coloration the common form are greyish above with carrot-coloured lateral bands, and 2 irregular series of carrot-coloured spots on the posterior part of the back continuing down middle of tail. This beautiful colour is beginning to bleach in several specimens.

Distribution: Tunis, Egypt, Cyprus, Syria, Armenia, Transcaspia, Persia, Baluchistan. Waziristan is probably the Eastern limit of its range.

OPHIDIA.—By Capt. C. M. Ingoldby.

The collection comprises 18 species. To these I have added one (*Pseudocerastes bicornis,* Wall) although I did not obtain a specimen, for the sake of making the list as complete as possible; it was discovered in the Gomal Valley at Khajuri Kach.

The occurrence of *Tarbophis rhinopoma* is worth mentioning on account of its rarity within Indian limits. Previous examples have been recorded from Sind (1 specimen) by Boulenger, Journ. N.H. Soc. Vol. 9, p. 325, and from Baluchistan (1 specimen) by Wall, loc. cit. Vol. XXIII, p. 167 under the synonym of *Dipsadomorphus jollyi.*

An interesting small series of *Eryx jaculus* was obtained.

Boidæ.

1.	*Eryx jaculus*	Kaur Bridge,	2 specimens.
		Wana,	2 ,,

If the above identification is correct, these specimens approach more closely to *E. johnii* than is usual even in these very closely allied species.

In the Cat. Snakes Brit. Mus., Boulenger separates the two species in his key to the genus as follows :—

40 to 50 scales across body; ventrals 165—200 *jaculus.*
54 to 65 ,, ,, ,, ,, 194—210 *johnii.*

Wall in his Common Snakes of India (Journ. Bomb. N. H. Soc., Vol. XXI, No. I, p. 2) gives the following figures for *johnii.*

51 to 65 scales across the body; ventrals 189—210 *johnii.*

In his notes on a collection of snakes from Persia (loc. cit. Vol. XVIII, p. 797) Wall describes six specimens of *jaculus* in which the scales were 50—54; ventrals 190—199.

In my notes of specimens examined in Mesopotamia I find that in three specimens the scales across the mid-body were more than 50, being 52, 54,

& 55 (the last was a semi-decomposed specimen 2′-7″ in length). The ventrals were 189—197.

In these specimens from Waziristan the lepidosis is as follows :—

Ventrals	194	Subcaudals	34	Scales	52
,,	200	,,	34	,,	54
,,	200	,,	35	,,	53
,,	206	,,	33	,,	56

A small point in addition which inclined me to the opinion that these snakes are *jaculus* was the appearance of the young, of which I saw three. In general appearance and markings these were indistinguishable from the young of *jaculus*, being more sharply and heavily marked on the body than adults, whereas in the few specimens I have seen of the young of *johnii* these were quite unmarked on the body, though showing black bands on the tail.

Note :—Since writing the above I have had the opportunity through the kindness of Miss Proctor of examining the specimens of *Eryx jaculus aad Eryx johnii* in the British Museum together with the specimens referred to above. This material confirms what I have suspected for some time that these two forms are not separable by any external feature.

In my opinion and that of Miss Proctor who has kindly examined these specimens, they should no longer be regarded as separate species.

The form from Peninsular India without, as a rule, any markings on the body, and with more than 50 scale rows in transverse series in midbody, might be called *Eryx jaculus*, var *johnii.*

COLUBRIDÆ.

Aglypha.

2. *Lycodon striatus.* Sarwekai 1 specimen.
Wana ,, ,,

Two points deserve mention as extending the range of distribution and colour variation given by Wall (Journ. N. H. Soc., Vol. 19, p. 102). These specimens were obtained at altitudes respectively of 3,600 ft. and 5,000 ft. One specimen shows 35, the other 32 transverse white bands between head and base of tail.

Both were of the beautiful colour variety in which each white transverse band meets in an enlarged vertebral spot of bright yellow.

3. *Simotes arnensis* .. .. ..Tank, 1 specimen.
D. I. K., 1 ,,

4. *Zamenis mucosus* .. .. ..Kot Kai, 1 specimen.
Wana, 2 specimens.
Ladha, 6 ,,

Most of the specimens seen were very dark coloured, almost black, with yellow bellies. Not met with in absence of plenty of water and shade. Common near Kaniguram.

In no specimen examined did the number of maxillary teeth exceed twenty.

Zamenis rhodorachis var *ladacensis.* Ladha 3 specimens.

Conform well in all respects to type.

6. *Zamenis ventrimaculatus* .. ..D. I. K., 1 specimen.
Kaur Bridge, 2 specimens.

Typical. These specimens agree well in markings and lepidosis with specimens from Mesopotamia. In one specimen from that country (length 4′-0″), the ventrals were 215. Except in this one respect it agreed with the

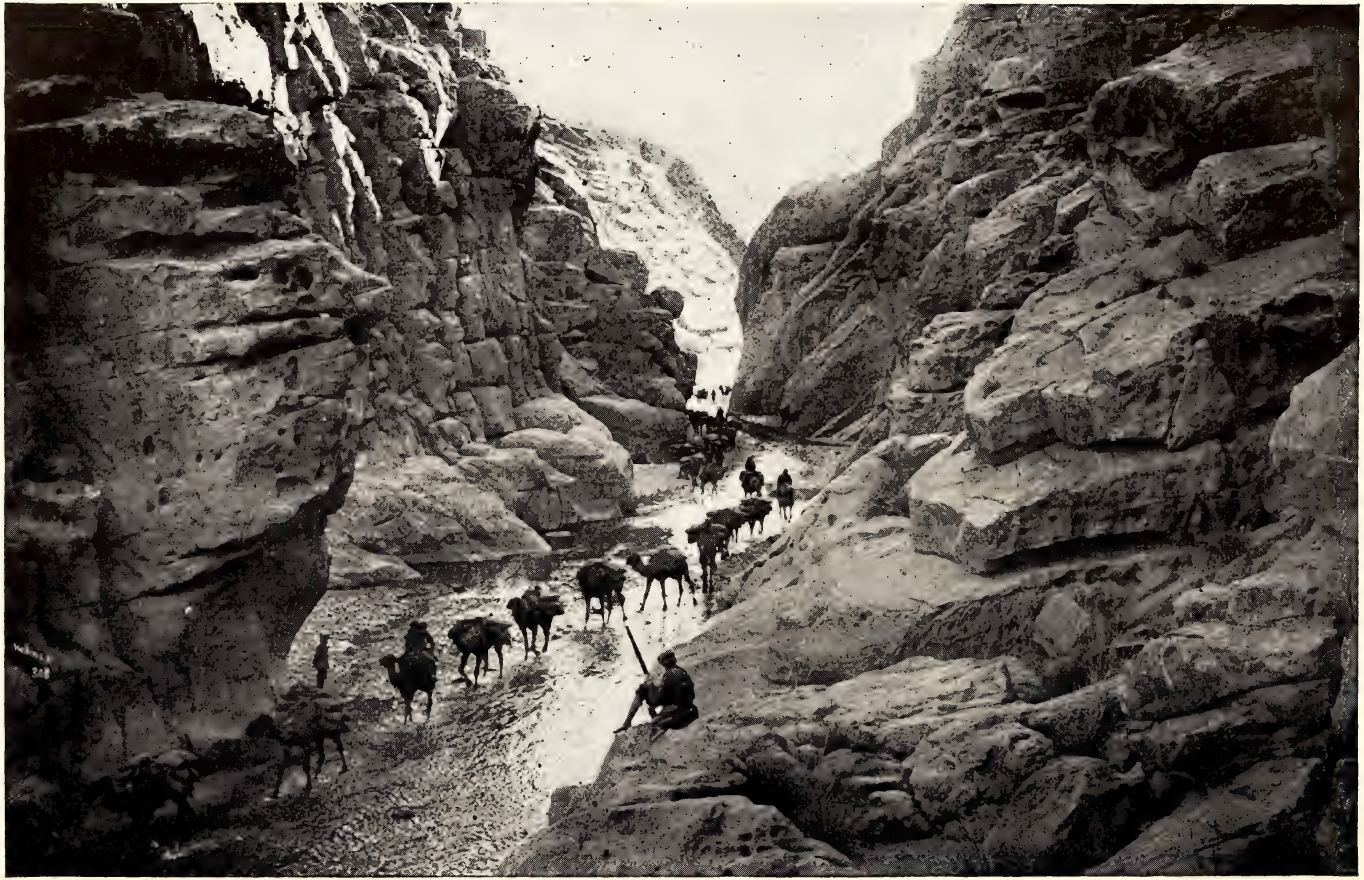

Photo by R. E. Holmes, Peshawar.

THE SHAHUR TANGI.

rest of a very large series all of which, like the three of this collection, agree well with the description in the Cat. Brit. Mus., Bouleng.

7. *Zamenis diadema* .. ..Kaur Bridge, 2 specimens.
Ladha. 4 specimens.

One specimen, half grown, was a melanitic form, being of a uniform dark slate-grey colour all over, the usual markings on back and sides showing through rather faintly. The remainder were all of the variety *atriceps* common in Sind and the Punjab.

8. *Contia angusticeps* .. ..Kirgi, 1 specimen.

One mutilated specimen minus a portion of the tail

9. *Contia persica* .. .. ..Kirgi, 1 specimen.

This specimen, which like the last was presented to me very kindly by Capt. Muirhead, was alive and entire. I was struck by the absence of any dark markings on head or neck except for a barely perceptible band across the neck of slightly deeper olive than the remainder of the upper surface, which was uniform olive.

Neither Mr. Prater nor I were able to identify it. It seemed to me closest to *angusticeps*, but differing among other characters in having the inter-nasal suture shorter than the suture between the præfrontals, and in markings.

Col. Wall kindly examined it and has pronounced it to be *Contia persica.*

Unfortunately I am unable to lay my hand on the notes I made on the lepidosis of either of these specimens, and the specimens, which were sent to the British Museum for a final opinion, have been lost in transit.

Opisthoglypha.

10. *Tarbophis rhinopoma* .. ..Kirgi, 1 specimen.
Jandola, 1 specimen.

Scale rows.	Ventrals.	Subcaudals.
23 23 17	278 a. s.	80
23 23 17	275 a. s.	82

In the smaller of these specimens there are three post-oculars on each side, and the parietals are slightly mal-formed with the tip of each partially severed, making them appear hardly, if at all, longer than the frontal.

This snake was originaly described by Blanford from Kerman, S. Persia. It is figured in Zool. E. Pers., Blanf. 1876.

11. *Dipsadomorphus trigonatus* .. ..Ladha. 2 specimens.
Wana, 5 ,,

A large number of these snakes were brought in to me by the Wazirs of the Wana plain, most of them hopelessly mutilated or dried up. While I never saw the uniform sooty black head of var. *melanocephalus,* in many of the young and half-grown specimens the head was very dark owing to black powdering of the shields and nuchal scales, and strongly irridescent.

Several very young specimens were brought in, all showing the same strong markings as adults.

In one specimen there are only seven supra-labials on the right side, 3 & 4 touching the eye. Nos. 2 & 3 appear to have fused.

In other cases only the fourth and fifth supra-labials touch the eye on both sides.

12. *Psammophis leithii* .. ..Kaur Bridge, 2 specimens.
Kot Kai, 1 specimen.

Not uncommon on the foot-hills and neighbouring plain. Usually noticed in or near a bush to which they invariably retreated when alarmed.

13. *Psammophis schokari* .. .. ..Kirgi, 1 specimen.
Jandola, 1 ,,

Found over the same area but less commonly than the preceding form.

In one example the 3rd & 4th supra-labials appear to have fused giving on the left side 8 supra-labials with 3 & 4 in contact with the prae-ocular, 4 & 5 entering eye.

Proteroglypha.

14. *Bungarus cœruleus* .. .. ..Jandola, 1 juv.

Scale rows.	Ventrals.	Sub-caudals.
15 15 15	215	50

15. *Bungarus sindanus* .. ..Jatta, 1 specimen.

Scale rows.	Ventrals.	Sub-caudals.
20 17 17	207	45

16. *Naja tripudians* .. ..Jatta 1 specimen.
Ladha 7 specimens.

With the exception of the plains specimen these were all obtained from above 5,000 ft. Most of them were brought in by Mahsuds from the neighbourhood of Kaniguram. All of these are of Var. *cæca*.

VIPERIDÆ.

17. *Vipera lebetina* .. .. .. Kaniguram .. 2 spec. ♂ 1.
♀ 1.

I never saw this snake alive. Both were brought in by Mahsuds. According to them it is not rare in the neighbourhood of Kaniguram. They regard it with dread, but rather as dangerous to themselves than to their animals. An interesting note is given by Aitchison in the "Zoology of the Afghan Delimitation Commission" 1889 .. "It causes much mortality among camels; owing to its extremely sluggish habits it will not move out of the way, trusting to its colour to escape detection; hence it is liable to be trampled upon, the result, of course, proving fatal to the trampler. It is called as already stated, "Shutar-mar*" by the natives, an honour divided between it and the Cobra of these parts."

Pseudocerastes bicornis.

No example obtained. Described by Col. F. Wall (Poisonous Terrestrial Snakes of B. India, p. 64) from a specimen obtained by Major O. A., Smith at Khajuri Kach.

18. *Echis carinatus var. nigrocincta* .. ..Manzai 1 specimen.
Kirghi 1 ,,
Kot Kai 1 ,,

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* Camel-killer.

NOTES ON A COLLECTION OF BATRACHIA FROM S. WAZIRISTAN

By

C. R. Narayan Rao, M.A.

(*With two text figures.*)

The material collected by Capt. C. M. Ingoldby was kindly sent to me by the Honorary Secretary, Bombay Natural History Society, to be examined and commented upon. The specimens are referable to the following species:—

(?) Rana hexadactyla. Rana cyanophlyctis. Rana limnocharis.
Rana tigrina. Rana sternosignata. Rana strachani.
Bufo melanostictus. Bufo olivaceous. Bufo stomaticus.

(?) *Rana hexadactyla,* Less.

1920. *Rana hexadactyla,* Less., Rec: Ind. Mus., Vol. xx., p. 10.

Larva.

1918. Annandale and Rao, Rec., Ind. Mus., p. 31, Pl. ii., Fig. 2.

There is only one specimen in the collection, without any label as regards the locality where it was taken, and according to Dr. Boulenger this species is purely S. Indian in its occurrence. The specimen itself is not in a very good condition of preservation and I assign it provisionally to this species. It agrees well with Dr. Boulenger's description.

Rana cyanophlyctis, Schneid.

1920. *Rana cyanophlyctis,* Schneid, Boul, Rec. Ind. Mus., Vol. xx., p. 12.

Larva.

1918. Annandale and Rao, Rec. Ind. Mus., p. 30, Pl. ii., Fig. 1.

The bulk of the collection comprises this species, and concerning these forms Capt. Ingoldby writes that " all the frogs were obtained from small pools and overflow or cultivation canals from the Gumal river and the Tank Zam". I seized the opportunity of comparing the measurements of these numerous specimens with my own collection and with the figures given by Dr. Boulenger (Rec. Ind. Mus., Vol. xx., p. 14) for the British Museum collection. The law that governs the proportion of development of the first finger, the diameter of the tympanum and the eye, the length of the snout and the interorbital width is very arbitrary and perhaps very complex. I have examined nearly one hundred specimens of particular sizes of this species and of *R. hexadactyla, R. tigrina* and *R. limnocharis* with a view to discover any relation subsisting among the structures mentioned, and within certain limits one can approximately fix the measurements of these structures, provided one of them is given. Thus the length of the first finger will be about $\frac{1}{8}$ in the total length of the body, $\frac{1}{3}$ in the length of first finger nearly equals the interorbital space in *cyanophlyctis,* slightly more in *tigrina,* less in *limnocharis,* and *hexadactyla* lies between the latter two in this regard ;

$\frac{4}{5}$ to $\frac{5}{8}$ in the length of first finger nearly equals the diameter of the eye in *cyanophlyctis, hexadactyla* and *limnocharis* and the two are of equal length in *tigrina* ;

$\frac{1}{2}$ of the length of first finger in *cyanophlyctis* and *limnocharis* nearly represents the diameter of the tympanum, less in *hexactyla* and more in *tigrina.*

The length of the first finger nearly equals the length of the snout in *cyanophlyctis, limnocharis* and *hexadactyla* and $1\frac{1}{2}$ times in *tigrina.*

The formula I have stated above is fairly constant in about 85 per cent. of the cases I have examined and the limits of error in the remainder lie between ·75 and ·5 of the normal proportions. The curves I have attempted to draw to express the proportionate relation of the different parts I have selected are most discontinuous and as I have mentioned already the equation that underlies them is most complex.

Structurally, the most noteworthy character common to the S. Waziristan specimens is the development of a cornified papilla on the outer margin of the external nares, which is a secondary protective adaptation developed in all the batrachians subjected to dust storms which frequently occur in the hot weather in these parts.

Rana limnocharis, Wregm.

1920. *Rana limnocharis,* Boul. Rec. Ind. Mus., Vol. xx., p. 28.

LARVA.

1918. Annandale and Rao., Rec. Ind. Mus., Vol. xv., p. 32.

There are several specimens of this species in the collection, taken in the same area with *R. cyanophlyctis.* I can discover no differences of any importance between these specimens and the S. Indian forms.

Rana tigrina, Daud.

1290. *Rana tigrina,* Boul. Rec. Ind. Mus., Vol. xx., p. 17.

LARVA.

1918. Annandale and Rao., Rec. Ind. Mus., Vol. xv., p. 34.

There are only two specimens in the collection and both agree well with Dr Boulenger's description.

Rana sternosignata, Murr.

1920. *Rana sternosignata,* Boul., Rec. Ind. Mus., Vol. xx., p. 71.

LARVA.

1918. Annandale and Rao., Rec. Ind. Mus., Vol. xv., p. 36.

There are more than half a dozen specimens in the collection from Ladha, 5,500 ft., which is just below Kaniguran, the Mahsud capital. I notice that Capt. Ingoldby's specimens differ somewhat widely in respect of measurements given by Dr. Boulenger (op. cit., p. 72), and I give them below as worthy of being put on record. Apart from measurements, the other peculiarities noticeable in several of the specimens are the cornification of the tips of digits, the corrugation of the abdominal skin, the presence of short glandular folds on the flanks. The warts on the skin, tipped with horny spines, are usually surrounded by a circlet of smaller warts similarly tipped with spines.

THE MEASUREMENTS OF *R. sternosignata* IN MM.

Two typical forms are selected.	1	2
From the tip of the snout to vent	72	72
Length of the head	26	26·5
Width of the head	30	30
Snout	11	11
Inter-nasal width	6	6

Two typical forms are selected.	1	2
Inter-orbital width anterior 5·5 post. 8 mm.	6	6
Distance between the eye and nostril	5	5
Diameter of the eye	8	8
,, of the tympanum	4	4
Distance between the eye and tympanum	4·5	5
Anterior limb (including the digit)	46	47 (16+31)
1st Finger	9·5	10·5
2nd ,, ...	11·5	13
3rd ,, ...	14·5	11
4th ,, ...	11·5	10
Hind-limb	105·5	111
Femur	25	26
Tibia	33	31
Tarsus	16	18
Foot	31	36
1st toe	12·5	12
2nd ,, ...	18	16
3rd ,, ...	24·5	21
4th ,, ...	31	30
5th ,, ...	22·5	23
Metatarsal tubercle (inner)	5	5
Breadth of tibia	11	10·5

The measurements of the remaining six specimens agree with the above in general proportions.

Included in the collection there are several tadpoles of all stages, belonging to this species, and Dr. Boulenger writes about them as follows (op. cit., p. 72):—"The large tadpoles (up to 90 mm. long) from Quetta, 5,700 ft., for which I am indebted to Dr. Annandale, are remarkable for the very strongly marked lines of sensory canals, which are black (preservation in formalin)." In the description of the larvæ in the paper cited above, no reference is made to the "Sensory Canals" which are certainly a striking character. A piece of skin, cleared in acetic acid, bearing these Sensory Canals, shows under the low power of the

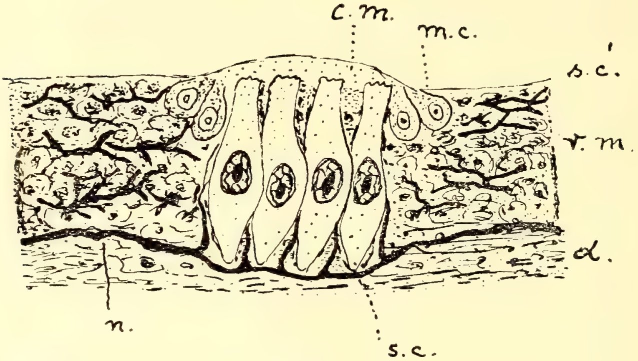


Fig 1.

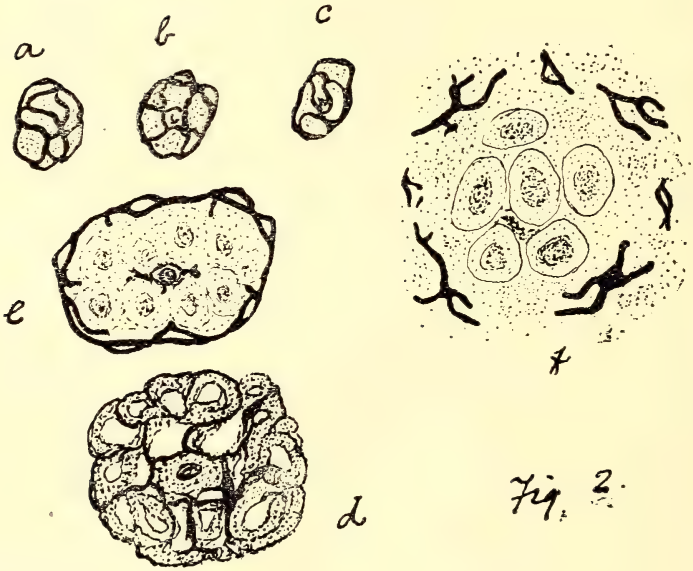


Fig. 2.

microscope a series of peculiarly shaped melanoblasts arranged in rows. In text figure 2, *a*, *b*, *c* represent such cells: *d* is an isolated cell mounted in glycerine. This cell embraces a number of ordinary epidermal cells within its dendritic branches, thus simulating the appearance of a sensory structure. In the examples at my disposal it is possible to follow the fate of these curious melanophores. At the posterior parts of the "canals," they are in a process of disintegration, the dendrites become thick melanin cords and still surround, as in *e* Fig. 2, the cutaneous cells, in the midst of which the nuclear remains are visible. In Fig. *f*, the degeneration is complete and the pigment bodies have separated and lie round the group of integumentary cells which they held together. For the propose of comparision with these bodies, I am giving in Fig. 1, a section of the true tactile sensory body from the larva of *Rhacophorus maculatus.*

Rana strachani, Murr.

1920. *Rana strachani* Boul., Rec. Ind. Mus., Vol. xx., p. 106.

There is only a single specimen in the collection and I have nothing to add to the excellent description of this species by Murray

Bufo melanostictus, Schneid.

1980. *Bufo melanostictus,* Boul., F. B. I. Rept. Batr., p. 505.

These are several examples of this species in the collection and they do not call for any remark.

Bufo olivaceous, Blanf.

1890. *Bufo olivaceous,* Boul., F. B. J. Rept. Batr., p. 504.

The two specimens included in the collection agree well with Dr. Boulenger's description.

Bufo stomaticus, Lütk.

1920. *Bufo stomaticus,* Rao, J. B. N. H. Soc., Vol. xxvii., No. 1., p. 125.

As regards this toad, of which there are several examples in the collection, Capt. Ingoldby writes that they " were dug up from dry stony ground with no apparent means of exit. One of these specimens was buried some 4 ft., when found it was just alive, but almost without power of movement; it was caked up with hard soil which could not have been disturbed for a great length of time. We found it in the course of digging out a specimen of *Uromastix hardwickii* which are abundant in that part (Kaur bridge)." A prolonged period of æstivation on the part of batrachians affecting dry situations subject to periods of long drought is fairly common and the specimen alluded to by Capt. Ingoldby is in a state of emaciation.

THE FAUNA OF THE DARBHANGA DISTRICT, NORTH BIHAR

By

C. M. INGLIS, F.Z.S., F.E.S., M.B.O.U.

In Vol. XIII. p. 621 and subsequent numbers I published a list of the "Birds of Madhubani Sub-division of the Darbhanga District" and from time to time added the occurrence of new species and notes on the rarer species got in other parts of the district, so that the whole comprised a fairly accurate account of the birds of the whole district. Since then I have pretty well worked out the butterflies and dragonflies and also done something in the mammals. N. A. Baptista, one of the Society's Mammal Survey collectors, has also collected here, under my supervision, for a short time, and with the help of this collection, my own observations, and some notes by Mr. G. Dalgleish in the "Zoologist," I hope to be able to give a fairly good list of those. My brother, Mr. H. A. Inglis, has worked out the fishes and is at present engaged on the Hymenoptera Aculeata, Rhynchota and some families of the Coleoptera, and lists of these, I hope, will be published later on. I also think it may be advisable to collect together my scattered notes on the birds and give a resume of the same, also adding any further notes which I have got.

My brother and myself have to thank Mr. Bainbrigge Fletcher and his assistants at Pusa for their most valuable help in the identification of species and for their kind encouragement, without which these papers on insects could never have been published.

Our collecting has been confined to a comparatively small area, but I doubt whether much more would be added had we had opportunities of collecting further afield.

In my former paper on the birds, Mr. H. W. P. Scroope, our present Commissioner and a keen ornithologist, kindly helped me with a short account of the general features of the Madhubani sub-division, and I now propose, with the help of the Gazetteer, to give a short description of the district as a whole. When the Gazetteer was published in 1907, this district was included in Bengal, but it now forms part of the new Province of Bihar and Orissa.

According to the Gazetteer: "The district of Darbhanga......lies between 25° 28′ and 26° 40′ north latitude and between 85° 31′ and 86° 41′ east longitude. It contains a total area of 3,348 square miles, and it is thus very much larger than any county in England or Ireland, except Yorkshire................its greatest length from north-east to south-west is 96 miles............

"The district is bounded on the north by Nepal, on the east by the district of Bhagalpur, on the west by Muzaffarpur, on the south-east by the district of Monghyr, and on the south-west by the Ganges which divides it from the Patna District.......The district formerly constituted part of Tirhut, a huge unwieldy district extending over 6,343 square miles; but this vast extent of territory, being beyond the administrative capacity of a single Collector, it was divided into two in 1875, the western portion being constituted the district of Muzaffarpur and the eastern and larger portion being formed into a separate district called Darbhanga after the name of its head-quarters. The name Tirhut is still, however, used as a convenient appellation for the country included in these two districts. (Tirhut has now been made a Division, C. M. I.)

"Darbhanga is a great alluvial plain with a general slope from north to south varied by a depression in the centre......The country lies on a low level, in many places identified with chains of shallow marshes....The rivers flow on raised beds, which they have gradually constructed for themselves out of the silt brought down from the mountains in Nepal. The alluvial plain diversified only by these river ridges, is rich in all sorts of crops. In some tracts nothing but an enormous stretch of rice-fields meets the eye, but in others the level plain is dotted with numerous clusters of bamboos and groves of mango and *sissu* trees.

"The district contains three main river systems—the Ganges, the Little Gandak, and the Kamla-Tiljuga group of rivers. The Ganges forms part of the southern boundary of Darbhanga and further north the Little Gandak separates the greater portion of the Samastipur sub-division from the rest of the district....to the north there is a network of rivers and streams called the Kamla-Tiljuga group, most of which converge on the south-east corner of the district. In the Madhubani and headquarters sub-divisions, practically all the rivers are liable to overflow their banks during heavy floods, but they rapidly drain off into the low-lying country in the south-east of the district, on which all the lines of drainage north of the Little Gandak converge. The most marked characteristic in this portion of their course is that they flow on ridges elevated above the surrounding country, and each pair of rivers thus encloses a shallow depression, consisting of a series of *chaurs* or low-lands leading into one another and forming the drainage channels of the country."

The Ganges is of course the largest river in the district and its channel, except when in flood, is usually about a mile broad. The Little Gandak rises in Nepal near Sumeswar, enters the district near Pusa and, flowing in a south-westerly direction, joins the Ganges below Monghyr. The Bagmati likewise has its source in Nepal, near Katmandu, takes a south-easterly course and joins the Little Gandak near Rusera. The Karai issues from the Kamla and Bagmati and runs into the Tiljuga at Tilakeswar. The Kamla flows south from Nepal through the Madhubani sub-division, where its old beds are scattered all over the country, past Darbhanga and then takes a south-easterly direction to the Ganges. The Tiljuga also rising in Nepal skirts the eastern boundary of the district. This river and the Kamla converge at Tilakeswar in the Rusera thana "and are thenceforward known indiscriminately by either name, while proceeding through Monghyr and Bhagalpur to join the Ganges and the Kosi by various tortuous courses."

There are no forests in the district but in some parts there are some uncultivated lands with bushes such as Ber (*Zizyphus jujuba*), etc., there are also patches of grassland, of various extent, used for thatching purposes, the largest of those being generally interspersed with Khair (*Acacia catechu*) and *sissu* (*Dalbergia sissoo*).

Round the villages are mango groves and bamboos and in some places, especially where there are Mahomedans, Palmyra (*Borassus flabelliformis*) and Date palms (*Phœnix sylvestris*).

The land is highly cultivated, the principal crops grown being rice, wheat, barley, oats, millets, maize, pulses, tobacco and chillies and, of late years owing to the erection of several large sugar mills, sugarcane is also grown to a large extent. Indigo is grown by the European planters, but not to such a large extent as formerly.

Although essentially a rural district, it is fairly densely populated, according to the Gazetteer the pressure on the soil being 870 to the square mile. There are only four towns—Darbhanga with its suburb Laheria Sarai, Samastipur, Madhubani and Rusera. Pusa is also now an important centre having the Agricultural Research Institute there. It is a pretty place with some fine teak and sissu avenues.

The climate is healthy and during the cold weather is especially good. During the hot months, dry west winds are prevalent which parch the land. "The mean maximum temperature ranges from 73° in January to 96° in April and May. The mean minimum temperature varies from 52° in January to 80° in July. The highest recorded temperature being 107° in 1894 and the lowest 38° in January 1878." The average rainfall according to the Gazetteer is 49·77 inches.

The present paper is on the dragonflies. I have to thank Major F. C. Fraser, I.M.S., for kindly identifying many specimens and for supplying some interesting notes which are given under his initials F. C. F.; he has also sent me a "Revised list of Indian Odonata," the classification of which is followed. Mr. Bainbrigge Fletcher, besides assisting largely in identifications, has kindly contributed some notes on the various species which appear under the initials T. B. F. I have also been fortunate in having had on several occasions access to the Odonata collection at Pusa and have thus been able to add some data from it.

ORDER. *ODONATA.*

SUBORDER. *ANISOPTERA.*

FAMILY. *Libellulidae.*

1.	*Potamarcha obscura*, Ramb	Noticed from 17th June to 16th November. Commonly seen on a pipal tree in the garden. [Common at Pusa during the rains and very fond of resting on electric wires.—T.B.F.]
2.	*Orthetrum tæniolatum*, Schn.	The only specimen was got on 4th November 1920.
3.	*Orthetrum sabina*, Dru.	Seen from April to the end of December. Common both over water and dry land.
4.	*Orthetrum pruinosum neglectum*, Ramb.	I have only once taken this here. It was got on 14th November 1921, whilst sitting on a shrub on the spoil bank of my tank. Mr. Fletcher has not got it at Pusa.
5.	*Palpopleura sexmaculata*, Fabr.	I have never come across this here, but one was got at Pusa on 10th January 1905.
6.	*Æisoma panorpoides panorpoides*, Ramb.	Got from 16th to the end of March, again from 7th April to the end of October. Found both round the edges of water and over dry land.
7.	*Brachydiplax sobrina*, Ramb.	Captured on 3rd May and from July to 27th October. Especially common in September. Got in dry paddy land, along hedges, etc. [At Pusa common in gardens during the rains, being most abundant about the beginning of August.—T.B.F.] [I have never seen this species away from water and am surprised to note the situations mentioned by you.—F.C.F.]
8.	*Diplacodes trivialis*, Ramb.	Noted on 25th March, 7th April, 15th May and from August to 16th November. Seen flying low over dry ground and sometimes over paddy lands.
9.	*Diplacodes nebulosa*, Fb.	Found all the year round. I have taken it at light in March. In habit it is much the same as *trivialis* but perhaps frequents water more than that species. [I agree with you that it is more generally seen near water; *D. trivialis* more generally over dry land.—F.C.F.]
10.	*Rhodothemis rufa*, Ramb.	Rather uncommon. I have taken them as follows: on 18th March, 3rd May and from 27th July till 6th November. The

		commonest place to find them here is on the spoil bank of my tank, where there are a number of bushes. It is usually seen singly or in pairs. [I have taken this at Gauhati and Shillong, but have never seen it at Pusa.—T.B.F.]
11.	*Neurothemis tullia tullia*, Dm.	Got from 11th March to the middle of April: one was captured on 1st July and others seen from August to 10th December. Commonly got in gardens and where there is jungle and also in paddy lands. I have sometimes noticed nothing but males, in fact it was some time before I secured females.
12.	*Neurothemis intermedia intermedia*, Ramb.	Two specimens taken at Baghownie in May on 8th September 1922. Probably occurs more commonly but is overlooked.
13.	*Crocothemis servilia servilia*, Dru.	Seen from January to the end of June. I seem to have only noted down one in July (14th) and again from August to the end of December. Seen everywhere, in gardens, over water generally in numbers.
14.	*Brachythemis contaminata*, Fb.	I have got this on 4th and at the end of March and from 7th April to 24th November. It is very common both over water and dry land, flying very low and in some numbers. This was very commonly seen while boating over a flooded area during the rains. [Abundant at Pusa throughout the warmer part of the year. Never seen away from the river.—T.B.F.].
15.	*Trithemis aurora aurora*, Burm.	I got a male on 20th June 1922, and specimens got at Pusa are dated 28th March 1919 and 30th December 1919.
16.	*Trithemis pallidinervis*, Kby.	This is common. I have taken one on 14th January and on 18th and 21st February, all through March, also on 2nd, 29th and 30th May and again from 29th July to 20th December. I have captured them "in cop" during August and October. It is often found near water but also got flying over dry land. Whilst boating during a flood it was very commonly seen flitting about and perching on grass and crops that were partially submerged. [Abundant throughout the warmer part of the year. Often seen in large numbers, thousands in one place. Common in gardens away from water.—T.B.F.]
17.	*Rhyothemis variegata*, Joh. ..	The earliest were seen on 21st March up to the middle of April and from May to the middle of July and from September to the middle of November. Sometimes solitary specimens are seen flitting slowly about, but often are together in a regular swarm, very commonly over dry land.

18.	*Pantala flavescens*, Fb.	..Found from June to the end of September. One was got on 17th October. Often seen flitting slowly about in groves in some numbers.
19.	*Tramea basilaris burmeisteri*, Kby.	The only specimens got by me were caught in my garden on 27th March and 13th November 1921 and on 22nd July 1922. At Pusa they were got on 15th December 1912 and 19th August 1915. [Not uncommon at Pusa from August to October.—T.B.F.]
20.	*Tholymis tillarga*, Fb.	..Got from July to 8th November. Seen during the day in groves, and in gardens and over water in evenings till quite late. While sleeping in the verandah during the rains I have often, on awakening early in the morning before sunrise, seen numbers of them flitting about evidently hawking mosquitos just beyond it. The opalescent patch on the hind-wing of the male is very striking. [Goes well into the cold weather. In December and January, when the mornings and evenings are chilly and probably few flies about, I have seen them hawking prey in the bright sunshine quite late in the forenoons. An abundant species at Pusa.—T.B.F.]
21.	*Zyxomma petiolatum*, Ramb.	I got a male on 28th June 1922 and Mr. Fletcher got one in his verandah at Pusa on the evening of 28th June 1921; just exactly a year previous to mine.
22.	*Æthriamanta brevipennis brevipennis*, Ramb.	Obtained from July to middle of August. Mr. Fletcher wrote to me that it was "scarce at Pusa and only got once there on 19th July 1920." It is here to be seen flying low over dry ground, often dry paddy land; not many seen together, only perhaps two or three.
23.	*Urothemis signata signata*, Ramb.	Specimens were got as follows: a few towards the end of March, one on 7th April, during the whole of May, one on 8th June and from July to 14th December. On 9th July I got one at light. This is common both flying over dry land and water, in gardens, etc., in some numbers; they sometimes fly at a considerable height.

SUBFAMILY. *Cordulinæ.*

24.	*Azuma frontalis*, Selys.	..Only one specimen got here. It was caught while hawking over my tank on 10th November 1920.
25.	*Azuma cyanocephala*, Hagen.	Two specimens got at Baghownie on 4th and 31st October 1922. They were hawking over dry land.

FAMILY. *Æschnidæ.*

SUBFAMILY. *Æschninæ.*

26.	*Heminax ephippiger*, Burm.	I have only procured two specimens, one of which was taken at light on 6th July 1920 and the other on 5th August 1922 while flying in the garden during the day. It was near a shrubbery from which it had presumably been disturbed. Mr. Fletcher got one at light at Pusa on 5th August 1920 and a female, also at light, on 16th July 1922, and there is another at Pusa, dated 10th July 1915. Mr. Fletcher wrote to me on 2nd August 1922 : "*Heminax* was very common here yesterday evening in my garden, more than a dozen flying about round the bungalow, but all twenty feet or more up and I could not capture any. The only two I have ever caught here have been at light. Probably they hide in bamboo clumps or bushes in the daytime and could be caught then." [I have also seen what I take to be this species hawking about in the late evening from March onwards.—T.B.F.]
27.	*Anax parthenope parthenope* Selys.	[One specimen in the Pusa collection labelled as having been taken in a rice-field at Pusa on 9th July 1906.—T.B.F.]
28.	*Anax guttatus*, Burm.	I first came across this during 1921. The first pair were got in a field of *rahar* (*Cajanus indicus*) at Bunhar, a factory close to here, on 22nd September. I secured another specimen in my garden on 3rd November and again saw it also in my garden on 31st October and during the first few days of November. I saw another one at Bunhar on 6th December. Except for the two got together at Bunhar I have only seen single insects and they used to frequent the garden from 11 a.m. till 2 p.m. flying fast and pretty high up. I made several unsuccessful shots at them, but after leaving the place they generally returned. During the few days I noticed them, they kept the same beat and the single insect was certain to be found between the abovementioned hours. Mr. Fletcher wrote to me on 22nd November 1921 : "I picked up a recently-dead male on the road here a few days ago and saw another flying about near Waini." I saw one in my garden about 11 a.m. on 11th July 1922 but failed to catch it. [I think there is no doubt but that we had a local immigration of *A. guttatus* into the Darbhanga

district in 1921. Otherwise, it is incredible that so large and distinct an insect should have escaped observation at Pusa during the last sixteen years.—T.B.F.]

29. *Gynacantha bainbriggei*, Fraser. There are specimens in the Pusa collection got there on 17th June and 31st July 1916. I have never come across it here. The identity of this insect was doubtful, but Major Fraser writes me that it is undoubtedly *G. bainbriggei*. [More often seen hawking about in the evening than caught.—T. B. F.]

SUBFAMILY. *Gomphinæ.*

30. *Ictinus rapax*, Ramb. ..I have got this on 20th March and from 23rd May to 29th October. It is the only common large dragonfly found here and during the rains is commonly seen flying over water, but it is also got over dry lands, in gardens ; sometimes flying at a considerable height.

31. *Ictinus clavatus*, Selys ..[One specimen at Pusa on 12th July 1915—T.B.F.] Mr. Fletcher thinks the identification may be doubtful and Major Fraser wrote to me that this species had not yet been procured in India. [This specimen was named *clavatus* by Major Fraser. I cannot see that it differs from *rapax* and presume that the name *clavatus* was a *lapsus calami*.—T.B.F.] [I have since come on my notes and a good sketch of the Pusa specimen, I evidently identified it by Williamson's key, but on looking up. Selys I find that the description does not agree in several details, and it is doubtless (*Ictinus atrox*, Selys)—F.C.F.]

32. *Gomphidia T-nigrum*, Selys..The single specimen got here was caught on 5th November 1920. Mr. Fletcher wrote that he had not got it at Pusa.

33. *Onychogomphus lineatus*, Selys.I have never found this here. There is a specimen in the Pusa collection got there on 10th March 1920.

34. *Anormogomphus heteropterus*, Selys. Major Fraser writes he has a specimen from Bihar, but does not mention the locality. There are no specimens in the Pusa collection nor have I ever come across it. [I can find no mention of the locality of my specimen except in my own handwriting which say "Bihar" Possibly I received it from Fletcher in the early days when he first started sending me specimens. It is a teneral ♂, I have no doubt that the locality is correct. They are very small and colourless insects and might be difficult to spot.—F. C. F.]

35. *Platygomphus dolobratus,* Selys. I have only got three, all females, on 14th July and on 13th and 30th August 1922. It is got at Pusa from the end of June through July and August. Mr. Fletcher informs me that it likes thick canna beds. [Usually quite common at Pusa in July and August: It is curious that its distribution seems to be so local.—T.B.F.]

36. ..A *Gomphine* female was got here on 27th June 1922, which Mr. Fletcher wrote was new to him ; so far it remains unidentified.

SUBORDER. ZYGOPTERA.

FAMILY. *Cœnagrionidœ.*

SUBFAMILY. *Lestinœ.*

37. *Lestes umbrina,* Selys, ..I have got it here on 18th May and 11th August 1921 and there are specimens in the Pusa collection got there on 30th December 1919 and 18th October 1920.

38. *Lestes viridula,* Ramb. ..A common species found from August to 24th November. During indigo manufacture this is often seen hawking along the masonry walls of the vats. [One species of *Lestes* is common at Pusa in November, being found amongst bushes in gardens but I am not certain of its specific identity.—T.B.F.]

39. *Lestes nigriceps,* Fraser, M. S. There is a *Lestine* got at Pusa from June to August and I got one here on 18th June 1922. Mr. Fletcher writes : "The fresh adult male has a blue spot on neck and blue tail." He has sent some to Major Fraser for determination. [The new Lestine I am calling *L. nigriceps.*—F.C.F.)

SUBFAMILY. *Cœnagrioninœ.*

40. *Agriocnemis pygmaea,* Ramb. Common and got on the following dates :—The whole of January and June, 1st July. On 30th September a pair were got "in cop."; also all through October during which month several pairs were got "in cop."; as also during November and from then others were secured up to the end of December.

41. *Agriocnemis incisa,* Selys. ..Apparently uncommon. A pair were got "in cop." on 11th October 1920 and another one was caught on 5th August 1921.

42. *Agriocnemis lacteola,* Selys ..This also appears to be rare, the only specimen being got on 12th June 1921.

43. *Ceriagrion coromandelianum,* Fb. A very common species got as follows :—14th January; from February to the middle of June and from July to the end of December. I got a specimen with

red mites at the bases of the wings. I thought it was a different species till Mr. Fletcher pointed out to me that the red was due to mites. [Abundant in gardens in March. Less common later on. Very subject to the attacks of a red mite, so that the whole base of all the wings often looks bright red.—T.B.F.]

44. *Ceriagrion rubiæ,* Laid ..Apparently rare here, the only specimens being got on 22nd July 1920, 22nd August 1920 and 28th June 1921. [Not taken at Pusa. Perhaps passed over as *coromandelianum.*—T.B.F.]

45. *Ceriagrion cerinorubellum,* Selys. I got one on 28th October 1921 and another on 13th July 1922. [Not seen at Pusa. In Assam I have taken it over weedy ponds. —T.B.F.]

46. *Aciagrion pallidum,* Selys ..I have got this all through October, on 1st and 30th November and on 7th December. [An autumnal species at Pusa as elsewhere, going well into the cold weather. Common in November and found even in December. —T.B.F.]

47. *Pseudagrion decorum,* Ramb. This was got from 11th February to 5th March; on 29th June and from 20th August to the end of the month, also on the following scattered dates: 3rd October, 24th November and 30th December. Specimens were taken at Pusa on 30th December 1919, 26th March 1920 and 2nd April 1920.

48. *Pseudagrion microcephalum,* Ramb. The dates of the capture of this are 21st February, 4th March, 4th and 16th August, 20th October when a pair were got "in cop" and 17th December. There are specimens taken at Pusa on 26th March and 30th December.

49. *Pseudagrion bengalense,* Laid. I have got this species here on the following dates:—20th March, 20th July, 20th August, 12th and 17th October and from the 1st to the 5th November.

50. *Pseudagrion hypermelas,* Selys. Apparently uncommon here as I have only secured specimens on 1st October, 7th November and 31st December 1920.

51. *Pseudagrion laidlawi,* Fraser. I have got this from 6th to 24th November and on 18th December 1921. A single specimen was got on 30th October 1920 at Pusa by Mr. Fletcher.

52. *Pseudagrion spencei,* Fraser ..A common species here. I have got it on the following dates:—9th to 25th January, 3rd, 5th and 26th March, 2nd and 8th July, 4th to 8th August, throughout October and November and from 2nd to 21st December. I got it "in cop." on 29th October. Pusa specimens were dated 6th and 9th February.

53. *Pseudagrion rubriceps,* Selys. I have got this on the following dates:—19th January, 20th June, 8th to 13th August, 12th September, through October on 27th and 28th November and on 21st-28th December. There are specimens in the Pusa collection taken there on 9th February 1920, 17th March 1920 and 30th December 1919. I got it "in cop" on 9th October. [Common throughout the year. Never found away from the river.—T.B.F.]

54. *Ischnura aurora,* Brauer. ..Common specimens were seen and got all through January and February from 4th-12th March, during April, on 28th June, 22nd July, all through October, on 25th November and throughout December.

55. *Ischnura senegalensis,* Ramb. Specimens were secured on the following dates:—27th December 1920, 2nd January, 8th February, 3rd and 4th March 1921 and on 2nd January and 5th February 1922. Mr. Fletcher remarks that it is very curious that all our specimens are either very teneral or females. We have never got males.

56. *Ischnura rufostigma,* Selys ..Rare, I have got this on 14th April 1920, on 29th January and 2nd and 17th February 1922. A specimen in the Pusa collection was got there on 3rd May 1918.

57. *Rhodischnura nursei,* Morton. This species was found throughout January and February and from 3rd to 12th March, 13th April, 2nd-18th June, 11th August, in September, on 5th, 6th, 29th and 30th October in November and from 19th December to the end of the month. I got a pair "in cop." at Bunhar on 7th June. At Pusa it has been got on 19th February 1919, and during March. In June it was common along the Bagmati where there were rushes but I have also got it over dry land.

58. *Enallagma parvum,* Selys ..This was obtained on the following dates:—All through February, 10th April, 13th May, 3rd July when a pair were got "in cop.", 21st August, all through September and October, on 15th and 18th November and on 12th and 14th December. Pusa specimens were got during March and December. [Abundant in gardens throughout the warmer part of the year.—T.B.F.]

59. *Cœnagrion dyeri,* Fraser ..I have only taken three specimens on 19th February and 1st March 1921 and on 12th January 1922. This is a rare species.

(*To be continued.*)

FLIGHT OF MIGRATING BIRDS.

By

C. H. Donald, F.Z.S., M.B.U.

This has proved a bone of contention among naturalists for many years and though much has been done, of late, in discovering various details with regard to the flight of birds during migration, there still remains an enormous amount yet to be done.

Varied opinions have been given as to the speed, and the height above sea level, at which the bulk of birds fly. In the "Ibis" (the Journal of the British Ornithologist's Union) for October 1920, Col. R. Meinertzhagen dealt with both speed and altitude attained by migrants during their spring and autumnal flights, and he had the advantage of bringing into use aircraft, and aircraft instruments, for testing both height and speed. The conclusions drawn from a most interesting and instructive paper, by him, are as follows :—

"1. Birds need not, for the purpose of migration, ascend much beyond 5,000 ft. above the level of the earth, nor indeed do they.

2. Birds met with above 5,000 ft. are the exception and not the rule.

3. That nocturnal flight need not be higher than diurnal, and that, in fact, it is not.

4. That the bulk of migratory flight is conducted below 3,000 feet whether by day or night.

5. That under normal conditions, different species travel at different altitudes, some very low and some invariably high, but that during abnormal weather conditions, all birds are apt to fly low.

6. That during migratory flight, birds prefer to descend below cloud level, though this is not always the case. Exceptions probably occur when gaps occur in a cloud-bank, or where islands of land continue to be visible beyond or above the cloud area."

With regard to the effect of altitude on the flight of birds, Col. Meinertzhagen says :—"As regards an oft-voiced view that greater altitude makes flight easier for a bird, I can only quote the experience of our Royal Air Force, that as altitude increases, the machine has greater difficulty in maintaining its height and speed."

Again, in the "Ibis" of April 1921, page 228, Col. Meinertzhagen, in a paper on the "Velocity of Migratory Flight among Birds," says :—

"Moreover birds would experience greater difficulties in flying in the "more elevated layers of the atmosphere," as the atmosphere is rarer and therefore offers a less suitable mixture on which their wings can beat. They would experience the same difficulties as a man trying to swim in froth."

So much for Col. Meinertzhagen's opinions, which are based on a considerable amount of personal observation and a careful study of the experiences of other naturalists, and command attention.

The "Fishing Gazette" of 12th August 1922, quotes from the "Living Age", a popular lecture delivered by Professor J. Arthur Thomson, in which the Professor "corrected erroneous beliefs in regard to the speed with which migrating birds fly" and the belief "that migrating birds travelled at great heights, going even as high as ten thousand feet above sea level, but when birds were released from flying machines at such a height it was found that they were *overpowered by the cold and the thinness of the atmosphere.* It now seems that cranes and geese, the highest flying birds, usually travel at about 3,000 ft. The highest bird so far observed from aircraft is a sky lark, which was encountered six thousand feet up."

The above italics are mine.

Whereas Col. Meinertzhagen keeps to *ground* level the eminent English biologist reduces the height at which birds travel to *sea* level as his basis for judging height, and gives cold and the thinness of atmosphere, as the reason for birds not exceeding three thousand feet, with the one exception of the lark found at 6,000 ft.

Both are however agreed that rarified atmosphere is an important factor in deciding the height at which birds must fly, but what, one would ask, is the extent of the rarification which effects birds ?

There is, for instance, a vast difference between the air intensity encountered at 10,000 ft. and that at 20,000 ft. above sea level.

According to Professor Thomson birds are overpowered by the cold and thinness of the atmosphere at 10,000 ft. Moreover, this is not the condition of any particular species, possibly an inhabitant of low levels, but of all birds in general, but if this is the case, what about the avifauna which inhabits the snow line of the Himalaya and spends at least six months of the year at altitudes from 12,000 to 15,000 ft. above sea level and periodically ascends considerably higher than this even ? Why is not this vast concourse of birds overpowered ? Had the Professor spent some time at high altitudes on the Himalaya before embarking on his popular lecture, and had he seen a large number of species varying in size from the Wren to the Himalayan Griffon or the Lämmergeyer, he would have pondered further on the problem he set out to lecture on.

So far as India is concerned, little or nothing is known of the migration which bi-annually takes place over the Himalayan region.

It has repeatedly been stated and, I think, is generally believed, that most migrants keep to the courses of main rivers, that is, to comparatively low levels, for by flying along the courses of rivers they avoid the intervening mountain ranges.

If this were the case a very large and important portion of the migration problem could be, and would have been by now, easily solved. For here we have the direct routes marked out for us, from the plains of India right up to, or, at least, within a few miles of their breeding grounds, and yet, oddly enough, it is of this section that we know least.

How many sportsmen and naturalists can remember seeing geese, for instance, migrating up or down any of our main rivers, say a couple of hundred miles above where the river debouches on to the plains ?

The Jhelum is an honourable exception, but here again the conditions are abnormal. The wide valley and the expanse of water on the Woolar Lake for instance affords ample food and rest.

Just below that point and where it enters the sandy beds (and with miles of cultivation on each side), flights of geese are of daily and common occurrence, during the winter months.

It has been my good fortune to spend nearly a quarter of a century in distant tracts of the Himalaya. On the Chenab, the Sutlej, the Beas and the Ganges, respectively, I have spent both summers and winters. Ducks and waders I have met with frequently, but geese and cranes very rarely indeed.

On the other hand, I spent several years in Bhadarwar, in the S. E. corner of Kashmir and on the borders of the Chamba State. Here, one of my favourite shooting haunts was a ridge running down from Kablass, a peak something over 14,000 ft. and I usually camped at about 10,000 to 12,000 ft. This was from 1897 to 1905. This was evidently on the direct line of flight of migrating geese and I have seen and heard great skeins of them passing over from evening to morning day after day during the autumn. Some passed within a few hundred feet of my camp and others again could only just be seen or heard.

Now where did these birds come from ? Presumably the Tso Morari Lake, where they are known to breed in great numbers.

Thence, to India, they have three distinct courses open to them.

1. The first, and easiest as regards altitude, would be to fly due north for about 30 miles or so and drop into the valley of the Indus and come down that the whole way. A long route but, except at the very beginning, comparatively low flying the whole way.

2. Either S., or S. W. to the Spiti River and down it to the Sutlej in Bushahr State, and along it to the plains. The due southern course would mean high flying for about 50 miles and then comparatively low, *i.e.*, about 11,000 ft. and steadily descending. The S. W. course would mean high flying (16,000 ft. and over) for well over a hundred miles, and then a drop into the sandy bed of the Sutlej on the borders of the Hoshiapur District.

3. Due W. either into the watershed of the Chandar-Bhaga and, along it to where the two rivers become the Chenab, to Akhnoor, or due W. the whole way. Along the Chandar-Bhaga they would meet with a few ranges in the first portion of their flight which would necessitate high flying and thereafter descend steadily with the river, but the due W. course the whole way would mean a succession of ranges one after another and a continued flight at an altitude of 15,000 to 18,000 ft. for close on to 150 miles, to the borders of Bhadarwar and thence a drop of 50 to 70 miles either on to the sandy tracts of the Chenab at Akhnoor, the Ravee below Madhopur, or the Beas below where it joins the Chakki.

Yet this was undoubtedly one of the main routes of migrating geese, or if not even a main route, a passage which many thousands went over annually.

Col. Meinertzhagen, referring to a note of mine which appeared in the B.N.H.S. Journal, Vol. XXV., p. 302, giving an instance of cranes or storks which I saw from 14,000 ft. flying at close on to 20,000 ft. above sea level, mentions this as an "important scrap of evidence from India." Since then I have seen two lots of cranes flying high over Dharmsala Cantt. One lot of, I think, 12 passed over the station and I watched them through glasses till they disappeared into space in the direction of the Daulah Dhar Range. Another lot, of only two, I noticed coming up the valley while I was encamped at a place called Triund, at an altitude of about 9,500 ft. It was a lovely morning in early May and I watched them for about 20 minutes. One appeared to be enticing the other to follow it over the main range.

It would repeatedly ring up to a considerable height, followed only half-heartedly by the other, and return to its companion, both calling loudly the while. The second would only rise to about 11,500 or 12,000 ft. and then begin to lose elevation, whereas the other on two or three occasions went practically out of view, but had to return to encourage the other. Eventually they gave it up and I watched them descend right into the flooded rice fields far below, whence they had probably started.

If the courses of rivers had been migrating routes, hundreds of sportsmen must have noticed great skeins and " wedges " of geese and cranes at various times on their downward and upward journeys, and the fact that they have not been noticed goes far to show that the flights go over the mountain ranges, where it would be extremely easy for a man camped in one nallah to be oblivious of thousands of geese passing over a range a mile or so away.

How far birds, like aircraft, are actually effected, by " thin " air in so far as flight is concerned, it is hard to say, and without in any way doubting Col. Meinertzhagen's statement that birds in rarified atmosphere would experience the same difficulties as a man trying to swim in froth,it might be at least pointed out that thousands do it daily, and surely they would descend to lower elevations if they found it difficult. If one carefully watches birds such as Vultures, Lämmergeyers, Eagles, Crows, etc., whilst soaring at say 7,000 ft. above sea level and then climbs up to 12,000 or 14,000 ft. and watches them there, is there any difference, any greater exertion observable ?

If they found it as difficult to fly there as a man found it to swim in froth, surely more "wing work" would be noticed. More flapping and beating of the air to keep their elevation would be necessary. Personally, I have never been able to notice any difference, and the ease with which a Lämmergeyer or a Vulture quarters the rockey hill sides, or circles over the mountain ranges at 15,000 ft. *appears* in no way different to the same bird beating over the wooded ravines at 6,000 ft.

I have watched a Lämmergeyer breaking bones at close on to 14,000 ft. This necessitated his carrying up the bone to some 200 ft. or so above the ground, dropping it, and then coming down after the fragments, and again taking the unbroken part to repeat the process.

He was at this for the better part of an hour, and surely if he had found the operations more tiring, or more difficult of accomplishment, at 14,000 ft. than at say 7,000 ft. he would have taken his bone to a more congenial atmosphere, instead of struggling with it where he did.

If, again, such birds are not impeded by "thin" air why should migrants, such as geese, be? If on the other hand they are not, then the obvious route for them from their breeding haunts would very naturally be the shortest and these are the direct ones across the intervening mountain ranges.

Col. Meinertzhagen gives three speed records of migrating geese, *viz.*, 44·3, 50¼, and 55 miles per hour, respectively, but if, for the sake of argument we reduce this to only 35 miles as an all round average, the actual duration of flight from Tso Morari to the plains would be in the vicinity of six to seven hours, which permits of a reasonable assumption that the whole journey is done in one long flight.

If the courses of rivers were followed each flight would run into hundreds of miles, necessitating, in all probability, one or more halts for rest and food. On most of our Punjab rivers there is no "suitable accommodation." The deep and narrow gorges alternating between cliffs and wooded or barren hill sides are not the places to tempt geese or cranes, where enemies could crawl up to within a few feet of a gaggle, and the wheat fields found in such localities might, with fortune, tempt half a dozen weary stragglers, but would not provide a night's food for a decent sized skein.

A NOTE ON THE SPOTTED-WINGED GROSBEAK *MYCEROBAS MELANOXANTHUS* (HODGS.).

By

HUGH WHISTLER, F.Z.S., M.B.O.U.

I have always regarded the Spotted-winged Grosbeak as a very rare bird and had never met with it personally until this year (1922) at Dharmsala. As it appeared here in some numbers in the latter part of the winter and I received reports from both Simla and Raniket of similar incursions I am tempted to write and enquire whether any of our members have met with the bird this year and whether they can give any evidence for or against the theory that it is one of those species which appears erratically in certain years outside its usual limits?

To begin with examining the question of its distribution. According to the Fauna, B.I. Birds, ii., 202, it is found in the Himalayas from the Hazara Country to Sikkim at considerable elevations, and in Manipur. Hartert (Vog. Pal. Fauna, I., 60) adds to this the mountains of Szechwan in W. China. This however gives no hint as to the status or manner of distribution of the bird in this area.

The published records do not throw much light on these points. Jerdon's account (B.I., II., 386) in somewhat vague:—

"Has been found both in the North-West and in the South-East Himalaya, but more common in the latter region and chiefly at considerable elevations. In winter a few descend to the lower region, in which season I got one or two pairs near Darjeeling, and Hodgson obtained it in Nepal, where he says they belong to the Northern region, whence they wander into the central region, even in summer, in search of ripe stony fruits. According to Capt. Hutton this species 'comes to Mussoorie in flocks during March and April, and remains as long as it can find plenty of cherry stones to crack, after which it disappears.'"

The Manipur locality is based on Hume's record (S.F., xi., 286) that he obtained a female from a flock of about a dozen individuals on the 29th May when descending from the Limatol range into the Limata Valley: while Godwin-Austen received specimens from Koonchungbun further north in Manipur. There is a specimen from Kanpetlet 6,000 ft., Mt. Victoria, Burma (18 Nov. 1905) in the collection of the Society at Bombay.

For the North-Western Himalayas there are more records. Commencing from the west there is a specimen from Thandiani and another from Abbottabad (no dates) in the Hume collection.

At Dunga Gali the nest was taken by Captain Skinner (Jour. B.N.H.S., xviii., 907) on 22nd June 1908 and as there appears to be no other record of the breeding of this species the account may well be quoted. "The nest was in a Yew tree about 15 feet from the ground on the side of a steep hill, built on a branch towards the end, composed of a base or platform of twigs from the Silver Fir (*Abies webbiana*) on the top of which was a cup-shaped nest of moss lined with maidenhair stems and fine roots; diameter of nest 3½″, depth 1¾″ internal measurements. The outside of the nest was lined with some green stuff which remained green and did not dry up, which aided its concealment. . . . . . there was a full clutch of 3 eggs which are marked in the same way as that of *Pycnorhamphus icteroides* with streaks and blotches, only the markings are decidedly more reddish brown: the ground colour of the eggs is light green: the eggs were quite fresh. Size 1·08×0·8; 1·07×·84; 1·07×·8 ins. The nest was found building by my searcher about 10 days ago when we were working in nullah, height 8,000 ft."

Major Magrath has also recorded in the Journal that he was present at the taking of this nest and he goes on to say:—"This Grosbeak was rare though on the 23rd June I came across in one spot in Dunga Gali quite a lot of them."

Of Kashmir, Ward writes (Jour. B.N.H.S., xvii, p. 484) that he has not yet secured a specimen though the species has been recorded from various parts. These records however I have failed to trace.

A specimen from Chamba (no date) from Colonel C. H. T. Marshall is in the Hume collection.

At Simla, according to Beavan (Ibis, 1867, 141), this Grosbeak is apparently far from uncommon ; the Hume collection contains an undated specimen each from Simla and Koteghar, and the Tweedale collection contains a male (August 1876) and a female (June 1876) from Simla. Yet it is significant that Dodsworth never met the bird at Simla, and A. E. Jones never found it there in 12 years until the visitation mentioned below.

B. B. Osmaston records (Jour. B.N.H.S., xxviii., 151) :—

" I have only met with this bird on three occasions, and all three places where it was seen were in Upper Gahrwal. On two of the three occasions I came on a flock of these birds feeding on the fruit of ' Kaphal ' (*Myrica nagi*) the stones of which are cracked and the kernel extracted."

A specimen from Gharwal (24 Jan. 1905) is in the Society's collection.

Andrew Anderson obtained the species in Kumaon in June 1875.

The above records either imply that the bird is very erratic in the manner of its appearance in the localities that it visits or that it has been greatly overlooked of late years. But in the early part of this year it would seen to have visited the outer N.W. Himalayas in some numbers judging from the three experiences now to be recorded.

At Dharmsala it was met with by me as follows. In every instance about the wooded nallah which runs from the Depot Bazar between the Post Office and the Gazetted Officers' Residences at an elevation of 4,000 to 4,500 ft. :—

January 7.—A party of 5 in a wild cherry tree, feeding on the kernels.
January 12.—A party of nine resting on the top of a tall tree.
January 17.—A party of nine feeding on wild cherries (N.B.—One of the previous nine had been shot so this was not necessarily the same party).
Januray 22.—A single male calling at the top of an " Oui " tree.
January 25.—A flock.
January 29.—A flock in a ' Khirk ' tree in my garden.
January 30.—A flock in a " Oui " tree in my garden.
February 8.—A party.

A series of 10 specimens was collected from this visitation. How much later they stayed I am unable to say owing to the Royal Visit removing me to Lahore on duty.

It is worth remarking that about the same time a number of *P. icteroides* appeared in Dharmsala, whereas neither species of Grosbeak had been met in the station the previous winter.

At Ranikhet they appeared about the same time. Mr. F. Field (who kindly sent me a nice male) writes as follows in a letter, dated 26th March 1922 :—

" These birds came here about the 19th February and fed on the wild cherry, cracking the stones quite easily ; curious to relate in the first two lots I saw there was only one hen bird among a lot of over a dozen birds each time. Later I saw several hens and again a week ago they were evidently pairing off as a cock and hen went off together. I have not seen them now for some days. They were in flocks of 10 to 15 or 20 and frequented the wild cherry trees."

Whether at the same time they appeared in Simla I have no information : they were there however in all probability, as almost as soon as he went up from the plains Mr. A. E. Jones met with a flock of about 40 in the glen below Viceregal lodge on 2nd April. He met with them again about the same place on 14th April, if anything in larger numbers.

As indicated by the above records, this Grosbeak, in winter at any rate, is highly gregarious and occurs in small parties or large flocks. In disposition it is very sluggish and frequently very tame and confiding, allowing a close approach. As its favourite food is the kernel of the stone of the wild cherry it tends to frequent those localities where this tree is most abundant. While feeding, the presence of a flock may be detected by the sound of the incessant splitting of the cherry stones, similar to the noise made by a flock of parrots feeding on the seeds of the Sheesham tree. The wild cherry is normally a small tree, often growing in fairly thick jungle, so, while feeding the Grosbeak, is naturally easy to secure, but otherwise it is fond of perching at the tops of high trees and is then difficult to observe. When disturbed it usually flies high in the air, but the flight is somewhat hesitating and there is a tendency to circle round and return to the locality from which the birds have been disturbed, as if they were reluctant to move away.

The species has a variety of calls; the most familiar is a sort of rattling note, to be rendered by the syllables "Charraruk," somewhat similar to the distant call of a Magpie or Field-fare and easily recognised when once known. This is usually uttered in flight but may also be heard during feeding; it may be fairly well represented by shaking an ordinary match box containing a few matches. There is a pleasing mellow and somewhat oriole-like whistle resembling the syllables 'Tyop-tiu' or 'Tyop-tyo,' and a variety of parrot like notes.

There is also a remarkably human note like the exclamation 'an' when pronounced with an ascending inflection.

Magrath states that the berries of *Viburnum fœtens* are eaten in addition to the fruit of the wild cherry (*Prunus padus*). I have only experience of the latter being eaten by the bird; the actual pulp of the cherry is disregarded, the stone being neatly divided at the junction of the valves and the kernel extracted. Where the birds have been feeding the ground beneath the trees is littered with the open shells.

To work the huge jaws and to supply the necessary strength for the cracking of the stones there is extraordinary muscular development. The whole of the cranium from a line between the central point of the upper edge of the orbits is encased in a sheet of fleshy muscle, so that on removal of the skin the bone is not visible as in other Passerine birds; this sheet of muscle ranges from half a millimetre anteriorly to two millimetres posteriorly in thickness. To support it there is a very deep groove behind the orbit and the posterior edge of these cavities is produced outwards in a deep flange such as I have seen in no other bird's skull. There is also a marked bony ridge along the central axis of the cranium. The muscles run from this central ridge straight down on both sides, so that the skull stripped of the skin offers a rough resemblance to the back view of a man's head with the hair neatly parted all down the middle. The tongue is hard and horny, a rough cylinder with the tip obliquely scooped out to a point on the lower edge.

The orbit is comparatively small and the whole of the palate and cavities behind the eye are well filled in with bone and muscle.

I have examined 18 specimens of this Grosbeak including the choice series in Mr. A. E. Jones' collection. The following descriptions of the plumages may be of use.

Adult Male (*winter and summer*).—The whole upper plumage, sides of the head and neck, chin, throat, and thighs slaty black, each feather with an ashy margin more or less distinct, and a concealed white base; in some specimens the white bases of feathers on the mantle are tinged with yellow; wings black, the feathers margined with ashy, the inner greater coverts and tertiaries with an elongated oval pale yellow spot on the outer web near the tip, occasionally a few of the inner median coverts with whitish tips; a white spot at the base of a variable number of the primaries, but never on the first and second; the secondaries and inner primaries with a short white margin near the tip of the outer web; tail black; lower plumage deep yellow, with occasionally a few lanceolate black spots on the lower flanks; axillaries black tipped with yellow.

There is no spring moult; period of the autumn moult not known, but the Mt. Victoria specimen of 18 November is moulting the remiges.

Adult female (*winter and summer*).—Upper plumage black, the feathers edged with dull yellowish green and with concealed whitish bases; the feathers of the head, hind neck and mantle much marked with yellow, the forehead and superciliary streaks being almost pure yellow and the centre of the mantle almost equally black and yellow; a broad black band from the lores through the eye to the ear coverts; a black patch on the cheeks; sides of the face and neck bright yellow streaked with black; the whole of the lower surface bright yellow, marked heavily except on the chin, throat, lower abdomen and under tail coverts, with black oval spots; thighs mixed yellow and black; wing black, all the feathers margined with pale yellowish or greenish white, these margins being broadest on both webs of the median covers, and at the tips of the outer webs of the greater covers, tertiaries, secondaries, and inner primaries; a white spot at the base of a variable number of the primaries, but never on the first; tail black, outer webs faintly margined with greenish; axillaries mixed black and yellow.

Moults presumably as in male.

Juvenile plumage unknown.

1*st Winter Male and Female.*—Exactly similar to the adult female but that the yellow in the plumage is almost entirely replaced by creamy white, except on the lower abdomen and under tail coverts. There is a much smaller proportion of black in the feathers of the crown and nape, the superciliary streaks being therefore less noticeable.

The moults are unknown.

Soft parts.—(Both sexes, adult and first winter). Iris dark brown; orbicular plumbeous; mouth blackish slaty horn; bill bluish grey; culmen tip and commissure blackish grey; legs dull bluish slate; claws dusky.

Structure.—1st primary minute and hidden; 2nd, 3rd and 4th primaries subequal, the 3rd being longest, 5th primary 4-6 mm. shorter than the 4th, 6th primary 10-13 mm. shorter than the 5th.

Tail slightly forked, central feathers about 5 mm. shorter than outermost feathers.

Measurements in millemetres :—

	Bill from skull.	Bill from feathers.	Wing.	Tail.	Tarsus.
6 Adult Males ..	28–32	22·5–26·5	126·5-134·5	75·5–82·5	22–25·5
7 Adult Females ..	28–30·5	22·5–26·5	126–134·5	72·5–77	22·5–24
1 First Winter Male .	28	22	125·5	70	22·5
1 First Winter Female	28·5	23·5	126·5	75·5	22·5

It is possible that the species should be divided like most other Himalayan birds, into an eastern and a western race, but I have been unable to examine sufficient birds from the Eastern Himalayas to be positive on this point.

FURTHER NOTES ON SOME CEYLON BATS.

By

W. W. A. Phillips.

(Continued from page 452, Vol. XXVIII).

(With 2 plates.)

RHINOLOPHIDÆ.

Rhinolophus rouxi rouxi.—The Rufous Horse Shoe Bat.

Singhalese—Kerri Voula. *Tamil*—Sinna Vava.

One of the commonest bats in the Island. It is found at all altitudes, inhabiting every suitable cave, plumbago pit, or culvert that is not already occupied by some other species.

It also inhabits, more rarely, old houses and farms, hanging from the roof tree throughout the day—Usually it is found in colonies—small or large according to the accommodation available—but sometimes singly or in small portions of two or three. It is often found sharing caves, etc., with small colonies of *Hipposideros speoris* and *H. atratus* but when this occurs the different species invariably keep separate and have their own nesting places.

The sexes live together—apparently all the year round. The breeding season is in April and May, the young being generally born about the end of April—but probably they occasionally breed at other seasons of the year as well. The female has only one young—one at a birth.

In the evening this bat is easily overlooked—It does not come out until it is fairly dark and then always flies low over the ground.

It prefers sweeping along the edge of a jungle, flitting in and out among tree trunks or up and down along the banks of a stream—in and out under bridges along narrow channels and the like—seldom flying more than about six feet up and generally within a foot or so off the ground—beating backwards and forwards over two or three hundred yards.

It is probable that, like certain other bats, each individual of this species has its own recognised territory or beat, to which it returns night after night. It often enters houses at night—being in the habit of flying up and down verandahs and in and out of windows of ground floor rooms.

If disturbed in the day time, it will fly out of its cave, or other resting place, and, after flying round, will often alight in a tree—hanging head down from a small twig in the darker and thicker part of the foliage. Normally however it always seeks a cave, or like place, in which to pass the day.

The colour of the fur of this species varies greatly in different individuals. Typically it is reddish brown but dark smoky brown and bright golden brown specimens occur.—The colour variation occurs chiefly among the males.

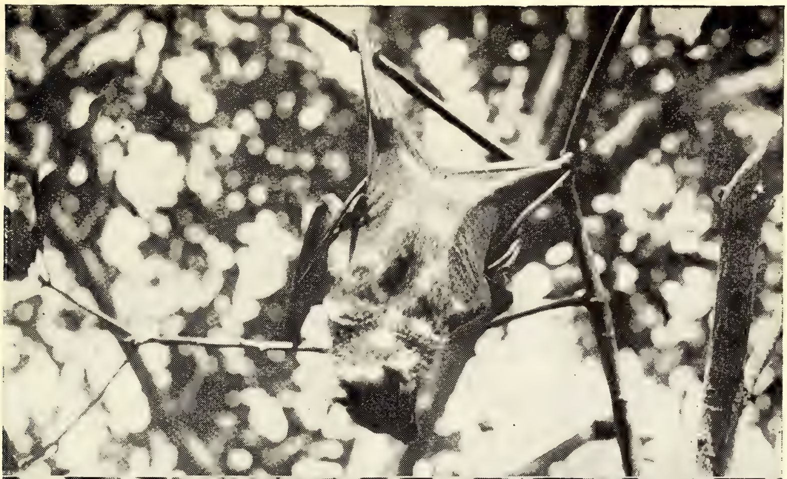
Rhinolophus beddomei sobrinus.—The Great Indian Horse Shoe Bat.

Singhalese—Voula or Kerri Voula. *Tamil*—Vava.

This, the largest of the Horseshoe Bats, is somewhat uncommon in Ceylon and has only been recorded a few times.

It lives generally solitary or in pairs, hanging by day in caves, or from overhanging rocks, in dark and secluded portions of the jungle. It is a jungle loving species and is rarely seen away from the heavy forests.

Its habits are probably much the same as those of the last species (*R. r. rouxi*) except that it keeps more to the interior of the jungles.



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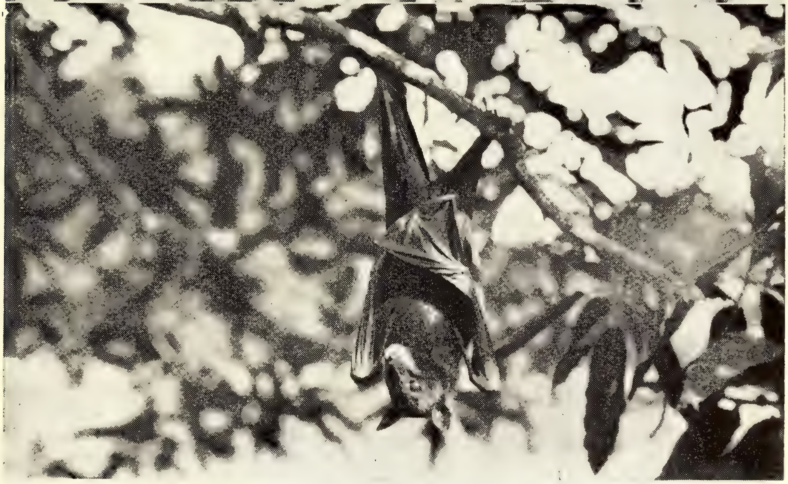

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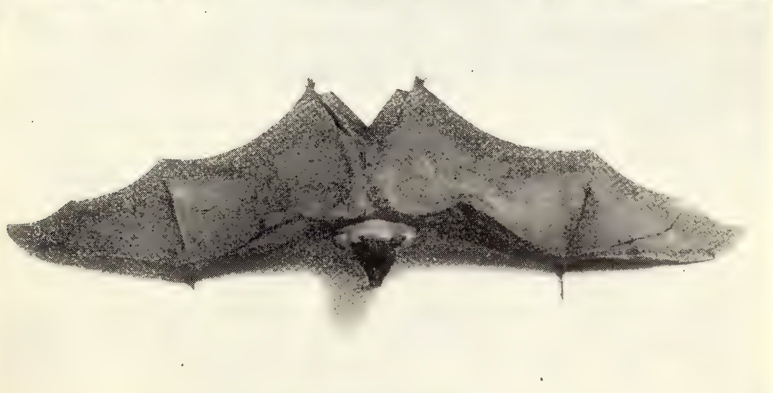

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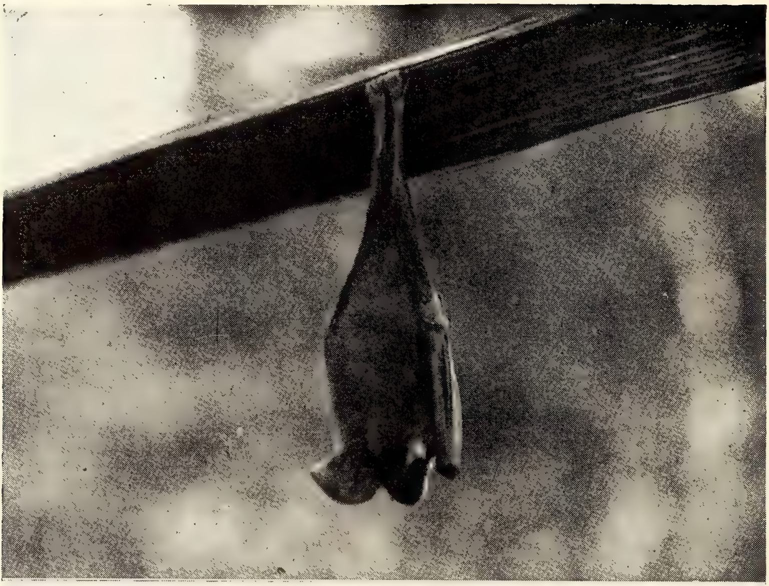
Pteropus giganteus giganteus.—The Common Flying Fox.
1 and 2. Climbing in Mango tree.
3. Showing the wing expanse of 4 ft.



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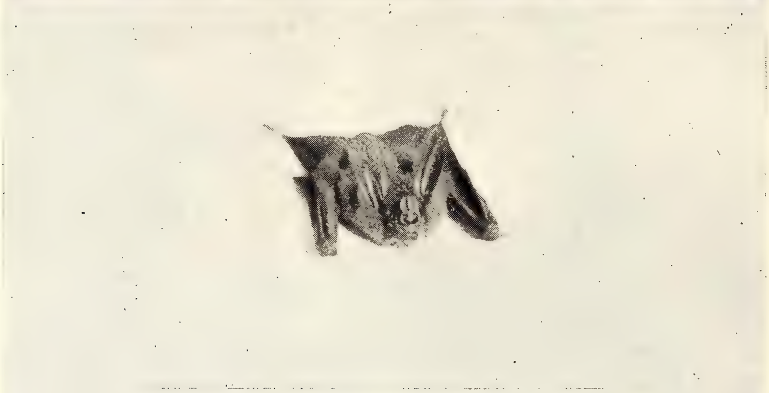

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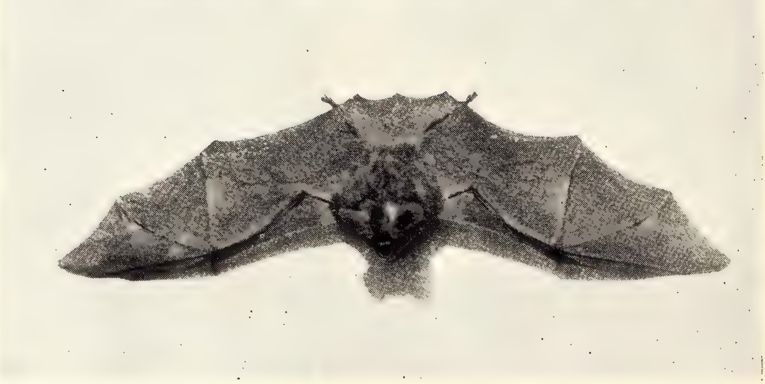

3.

1 and 2. *Megaderma spasma ceylonensis.*—The Ceylon Vampire Bat (about ½ natural size).

3. *Hipposideros atratus.*—The Ceylon Leaf-nosed Bat (under ½ natural size).

Hipposideros speoris speoris.—Syke's Leaf-nosed Bat.

Singhalese—Kerri Voula. *Tamil*—Sinna Vava.

Although not so common as the Rufous Horse shoe Bat, the present species is found in very considerable numbers all over the low country. In all probability it ascends the Hills as well, to at least an altitude of 3,000 feet to 4,000 feet; but it does not seem to have been recorded from there yet. (As however little or no work has been done on bats in the Hills, this is not much to go by). It lives in large colonies, often of several hundreds, in caves, caverns or disused buildings—hanging to the roof or sides in great clusters—looking like nothing so much as huge swarms of gigantic bees, the likeness being much accentuated by the continual movement of the Bats. The two sexes live together, and sometimes have their caves in common with a colony of *R. r. rouxi*—living separate to, but sharing the same outlet with them. The caves very soon become foul and evil smelling—having a peculiar, indescribable, nasty odour, due to the accumulated droppings—which odour, to a lesser extent, also clings to the bats themselves. Like most of the *Rhinolophidœ* it is a low-flier seeking its prey within a few feet off the ground, and having general habits, breeding season, etc., similar to those of *R. r. rouxi.*

Hipposideros brachyotus.—The Dekhan Leaf-nosed Bat.

Singhalese—Kerri Voula. *Tamil*—Sinna Vava.

The Dekhan Leaf-nose may easily be confused with *H. h. speoris*—the last species—superficially they are much alike, their size and characteristics being much the same. But while the present species has a comparatively large nose-leaf and long silky fur, *H. h. speoris* has a smaller nose-leaf and short smoke-brown fur. Their habits seem to be entirely different.

H. brachyotus does not congregate into large colonies but lives singly, in pairs or in family parties (of a male, female and young one) in small caves, large holes beneath rocks, or under overhanging rocks—often in fairly open country. It is very frequently found among piles of rocks, such as are common on Rubber estates in the Western low-country of Ceylon, living in the small caves formed by the boulders leaning up against one another.

Here it passes the day—cleaning and grooming itself or sleeping ; but always on the alert to take flight on the slightest rustling sound—which rather leads one to believe that it fears the attacks of snakes or monitor lizards which are common in such places.

When at rest, hanging from the roof by either one or both feet, its nose-leaf and ears may be observed to be continually vibrating and twitching, as it seems to test the air for sound or scent.

The single young one is born in April and, as usual, remains clinging to the mother. Even when well grown and able to fly a little, the mother will show much solicitude for it—returning to it again and again if in danger—regardless of close human proximity—the while uttering a very soft shrill squeak.

The young, when full grown, is so dark brown as to be almost black and very much darker than its parents—it seems probable that in the case of the male the older it gets the lighter and brighter coloured the fur becomes. This bat is found sparingly scattered all over the island ascending the hills to at least 3,500 feet but nowhere seems to be at all common.

Hipposideros atratus.—The Ceylon Leaf-nosed Bat.

Singhalese—Kerri Voula. *Tamil*—Sinna Vava.

This little Leaf-nose is very common all over the low country, though little seen in the evenings.

For day quarters, it is content with most possible situations—being commonly found in the tufts of Singhalese houses, in old dwellings, in caves, abandoned plumbago pits, dark culverts and, more rarely, in hollow trees—such as old Kitul Palms. It is found in colonies, of greater or lesser numbers, and sometimes sharing the same retreat with a few *R. r. rouxi*, but more generally by itself.

As long as its quarters are more or less dark it seems to be satisfied ; dampness causes it no inconvenience as, more often than not, the tunnels of the abandoned plumbago pits, which it so often inhabits, are more than half full of standing water.

When at rest, it hangs head downwards, gripping the roof with either one or both hind feet, its wings folded round it gently swinging backwards and forwards. Except perhaps when actually asleep, the nose-leaf and ears can be observed to be continually twitching and vibrating ; it seems to be never still ; while it is always on the alert to take flight on the least alarm.

It spends much time upon its toilet, grooming and cleaning itself, with much care, after its nightly flight.

Most of the year the females seem to live separate from the males—which are always very much less common. They and the males are found sometimes solitary, living in caves with small colonies of *R. r. rouxi.*

If disturbed in the day time, this bat will escape from its retreat and take refuge in trees—selecting the denser foliage in which to hide—where it will remain for an hour or more, returning to its quarters when the danger is past

If continually disturbed, however, it will soon desert its haunts and find new quarters elsewhere.

As with most *Rhinolophidæ* it is a low flier and rarely noticed in the evenings. unless especially looked for.

A NOTE ON THE *CORVIDÆ* OF THE PUNJAB

By

Hugh Whistler, F.Z.S., M.B.O.U., C.F.A.O.U.

The following note on the members of the family *Corvidæ* which are found in the Punjab has been written with two objects, firstly to shew in a concise form what species are known to occur, with their status and distribution, and secondly to indicate the gaps in our knowledge and the direction in which further investigations are necessary. The great advances of the last twenty years in the study of racial forms or subspecies has rendered necessary the overhauling of our knowledge of even the most common and well known birds. There is, for example, no more familiar bird in the whole of India than the Common House Crow, yet, as I have shewn below, it is not possible at present to mark the line of demarcation between two of its races which occur within the Punjab. A sufficient series of skins from different Punjab localities is still required to enable their respective distributions to be worked out.

The Punjab, for the purposes of this note, has been taken as the area which falls within the political and administrative boundaries of the Punjab Government. From a scientific point of view these boundaries are unsatisfactory as they include certain Himalayan areas which are faunistically quite different to the Punjab plain proper. But after due consideration of the respective claims of scientific accuracy and practical convenience, which need not be enumerated here at length, I have considered it better for the purposes of this note to follow official boundaries.

The Tibetan Raven.—*Corvus corax tibetanus* (Hodgs.).

The Tibetan Raven is a familiar species throughout the high wastes of Turkestan and northern Cashmere usually at an altitude of 12,000 ft. and upwards.

Within our area it is only found in the extreme north-easterly corner in the provinces of Lahul and Spiti. In the former I met with a few pairs in May and June at altitudes of 10,000 feet and upwards, and the Thakur of Lahul informed me that it was considered rare at that season, but that more arrived in autumn following the flocks which then come down over the Baralacha Pass.

Stoliczka obtained several specimens in Spiti, apparently in summer, previous to the year 1868. In July 1922 I met with a few in Spiti, at 13,000 feet or over. He records also a hearsay report that it is common in winter about Chini but that only a very few come down at that season to Kulu and Kotghar, and it is evident that the Tibetan Raven, while being strictly speaking a resident species in the areas that it inhabits, obeys the usual law that resident Himalayan birds move up and down to higher and lower altitudes according to the severity of the season and snowfall.

The finding of the nest within the Punjab boundaries has not yet been recorded. Fully fledged young, still with the parents, were seen on the shores of the Tso Morari Lake in early May by Ludlow (Jour., B. N. H. S., xxvii., 141) and Mandelli's men obtained the eggs in Sikkim in March. Nests with eggs were obtained at Gyantse on 15th February and 12th March by Bailey (Jour., B. N. H. S., xxi., 183).

The Punjab Raven.—*Corvus corax laurencei* (Hume).

This Raven is found throughout the Punjab territories with the exception of the hill area north of a line drawn from Pathankot to Kalka and Nahan. The only records north of this line are a single bird seen at Bukloh 4,000 feet and a pair at Dalhousie 7,000 ft. in June and July by Mr. A. E. Jones, and a pair seen by myself about Nurpur 2,000 ft. on 7th April 1921.

In the eastern and extreme south-eastern districts, where the general conditions approximate more to those of the United Provinces the Raven is distinctly scarce.

West of the line Hissar—Ludhiana—Batala it becomes exceedingly common and is found in considerable numbers throughout the remainder of the province. It is found alike in the sandy semi-desert plains from Sirsa to Jhang and Bhawalpur, in the canal areas of the Central Punjab, and in the bare rocky ravines of the Salt Range and the Rawalpindi—Attock plateau. Here it breeds right up to the base of the Murree hills as I have found the nest at Kahuta.

It may be met with throughout the year and is in the main certainly a resident species ;

But it is worthy of note that in northern Sindh (Hume, S. F., i., 205), Kohat (Whitehead, Ibis, 1909, 100), Sambhar Lake (Adam, S. F., i., 385) and Amballa (Beavan, Ibis, 1868, 165) former observers have declared that the Raven, while in part a resident, is in the main a winter visitor, and at Jhang in 1918 and 1919 I noticed that about September it suddenly became unusually numerous possibly due to the presence of migrating birds. So it is in the highest degree likely that a certain proportion of the Punjab birds are migratory, though the fact escapes notice owing to the large resident population and the dearth of observers. The habit of this bird of gathering in considerable numbers at all times in the outskirts of cities and cantonments, and in the hot weather of gathering to roost in large colonies also tends to obscure any migrational movements.

The breeding season in the Punjab lasts from early in December until late in March, and the great majority of eggs are to be found in January and February.

The Carrion Crow—*Corvus corone* (L.)

Although from the fact that the Carrion Crow is known to breed both in Kashmir and in the Upper Kurram Valley and to be a fairly common winter visitor to Bannu, it may be expected to occur within the Punjab Province, the fact has not yet been satisfactorily established.

Major Magrath recorded (Jour., B. N. H. S., XIX., p. 144) that some appeared about the ridge in Murree in July (1908) when the rains had broken. There were both adults and young and they were to be distinguished from the Jungle Crows by their caw.

I recorded (Ibis, 1916, 40) two supposed examples seen with other crows gathering to roost in the Forest Rakh at Jhelum on January 13th and 20th, 1914.

As in neither case specimens were obtained these records can hardly be regarded as satisfactory.

It has been stated that the Cashmere and N. W. F. P. Carrion Crow belongs to the race *Corvus corone orientalis* of Eversman. No proper series from this area is however available anywhere for critical examination, and it appears *prima facie* more probable that these birds belong to the western race. Under these circumstances, I have used only the Binomial name, and would urge any Indian Ornithologist who has the opportunity, to collect a full series of Carrion Crows.

The Rook.—*Corvus frugilegus tschusii* (Hartert).

There is considerable doubt whether this Asiatic race of the Rook is worth sub-specific separation, but as it has been recognised by the authors of the 'Hand Book of British Birds,' it may be allowed to stand here. The breeding quarters of the sub-species are North Persia, Turkestan, and South-Western Siberia, and in winter it moves south to Afghanistan, Baluchistan, Kashmir and the extreme north-western corner of India. Here it extends in two directions, along the country west of the Indus down as far as Quetta, and across the submontane area of the North-West Punjab. But as appears natural in a species of which vast hordes remain during the winter in areas north of the Himalayan Chain, the birds which arrive in the area south of that Chain appear to vary greatly from year to year both in numbers and in the time of their arrival and departure: this variation must be dependant on climate and food conditions in the main winter range.

In the Punjab area the Rook is found in the submontane tract which includes the districts of Campbellpore, Rawalpindi, Jhelum north of the Salt Range, and Sialkot. Here it arrives annually in greater or less numbers. Further south it is only a straggler. In the last week of December 1913 I observed a large number about the Civil Station of Gujranwala, and Currie has recorded large flocks at Atari in January. Mrs. Wathen has informed me that this winter (1921-22) she saw Rooks at Amritsar from November 16th till March 6.

Mr. F. W. Chanter recorded (S.F., X., 518) that he saw a flock of about 300 Rooks at Ludhiana on the 31st October 1884 and in an editorial foot note to this communication Hume stated that he had seen specimens from Hoshiarpur. I have not however met any in the Kangra Valley.

In Gilgit, Scully and Biddulph found that the Rook arrived about the third week in October and left again in April; and the former noted that it left Eastern Turkestan at the beginning of April. In the winter of 1913-14 at Jhelum I found that the vanguard arrived about the third week of October and the numbers continued to increase until about December, starting to decrease again about the second week in February; the majority were gone by the end of that month, although a few birds remained until the end of March. In some years however the Rook does not reach the Punjab until November but there is very little on record about the species.

West of the Punjab this bird reaches a more southerly point at Quetta. Here it is said to arrive usually about the middle of November and to leave again in March (Meinertzhagen, Ibis, 1920, 135), and to be very scarce in some years. At Kohat according to Whitehead (Ibis, 1909, 103) it arrives in November and remains as late as the middle of April. He remarks that the birds staying on through March are nearly all first winter birds, the adults apparently leaving about the beginning of March.

The Eastern Hooded-Crow.—*Corvus cornix sharpii* (Oates).

The Hooded Crow is a regular winter visitor to the North-West Frontier Province from Hazara to Bannu; it is very abundant in the Peshawar and Bannu Districts but is scarce in Kohat District which is less suited to its habits. Further north in Kashmir it appears to be decidedly rare.

I can find no record of its occurrence actually in the Punjab beyond Hume's statement (Stray Feathers, VII, 144) that it occasionally occurs as a straggler Cis-Indus. This doubtless refers to the Attock-Campbellpore District.

The Common House-Crow.—*Corvus splendens splendens* (Vieill.).

The typical race of the Common House Crow extends up from the Indian peninsular into the Punjab but it is not yet fully established where lies the boundry between it and *C. s. zugmayeri*; there is in any case probably an intermediate area where the House Crows cannot be definitely assigned to either race. For the present it must suffice to say that the House Crow, by whichever race represented, is a very abundant resident species throughout the Punjab up to the base of the Himalayas; it does not occur in the Kangra District but is common, in summer at any rate, in the southern half of the Kulu Valley from near Sultanpur to below Bajaura at an elevation of 3,000 ft. According to Stoliczka (Jour., A. S. B., xxxvii) a few occur along the villages of the Sutlej valley up to Koteghar.

It is common about Solon at 4,000 ft. and in March I saw a number in Kasauli Bazar about 5,500 ft. Jones records a single specimen seen at Annandale, Simla. No House Crow occurs in the Salt Range station of Sakesar.

In both races the breeding season starts with remarkable regularity, eggs being found from the middle of June until the end of July.

The Baluchistan House-Crow.—*Corvus splendens zugmayeri* (Laubman.)

It has long been known that the House Crows of the *Corvus splendens* group which occur so widely and abundantly throughout the Indian Empire are very variable in size and colour and that those of the extreme north-west of the Peninsula are remarkable for the purity and whiteness of the tone of the grey parts of the plumage. It was not however until 1913 that Laubman (Orn. Monatsber, 1913, 93) separated this race under the name of *C. s. zugmayeri* with the type locality of Baluchistan. It has not yet been possible, owing to a lack of specimens for examination from the intermediate areas, to fix accurately the boundaries between this race and the typical form. Hartert however (Vog. Pal. Fauna, p. 2023) lays down its range as South Baluchistan (Mekran, Somniani, Las Belas), Sindh, Mekran coasts, the south-east corner of Persia, and probably also the Punjab and Southern Kashmir.

That it occurs in the Punjab is now established beyond doubt. A series of 11 specimens collected by me at Jhang and 3 more from Jhelum are indistinguishable from Sindh birds and the birds of the Rawalpindi District are similarly remarkable for their white colouration. It may therefore be safely assumed that the range of this race extends up the whole of the Western Punjab and North-West Frontier Province from the Sindh border right up to the base of the Himalayas. How much further the race extends towards the Central Punjab is however not yet known owing to a lack of specimens for comparison. An isolated colony occurs in the Kashmir Valley at 5,000 feet, but in the Murree Hills it apparently does not go above Tret in Summer.

This race exhibits the tendency to albinism which is found in other Crows. Three albinistic specimens were obtained by me at Jhang (2,192 ♀, 5. v. 18; 2,655 ♀, 5. xii. 18; 2,674 ♀, 11. vi. 19) in addition to the normal series mentioned above and I also saw other examples.

The breeding season is remarkably regular, eggs being laid in the second half of June and in July.

The Jungle Crow—*Corvus coronoides intermedius* (Adams).

The Jungle Crow is found in abundance throughout the hill area of the North-Eastern Punjab, that is to say in Chamba, Kulu, Lahul, Saraj, Kangra and the Simla Hill States; where the Outer Himalayas again come into the Punjab boundary about Murree it is also abundant. In summer it occurs at least as high as 15,000 ft. but probably the majority do not breed much above 9,000 ft. while many breed along the edge of the plains as at Gurdaspur, Malikpur and Nurpur. In Lahul it appears to be only a summer straggler following the pack animals on the Himalayan Tibet trade road. While in the main a resident species this bird changes its altitude according to season to a noticeable extent.

As regards the plains, my information is very incomplete; a certain number drift down, during the winter months from November to February, to the submontane area from Kalka to Ambala.

Jones has noted (Jour. B.N.H.S., xxvii., 794) that it is common in winter about Attock and in the Kala Chitta Hills and that a few occur about Campbellpore. I failed to find it in the Rawalpindi plain and the Jhelum district, and throughout the whole of the main Punjab it certainly does not occur.

Across the Indus in the N.-W. F. Province at Kohat and Bannu it is an abundant winter visitor from the end of October and beginning of November until the middle of April or well into May.

Some form of Jungle Crow appears along the eastern border of the Province but information on this point is very incomplete. Currie implies (Jour. B. N. H. S., xxiv., 602) that it occurs at Karnal. Bingham long ago recorded (N. & E. 2nd Ed., I, 6) that he had only seen a single pair at Delhi.

It is not improbable that about this area *C. c. intermedius* is replaced by the Peninsula Indian Form *C. c. levaillantii* Less., a slightly larger bird with a stronger bill more bowed on the culmen.

Information as to its breeding in our area is also meagre. The breeding season at Simla is said to be from the end of March till the first week of May; Currie records a nest under construction at Gurdaspur in March and I found feathered young in a nest at Nurpur on 15th April. I took c/4 hard set eggs near Dhelu (4,500 ft. Mandi State) on 14th May. In Kulu it appears to breed later as I found naked young in a nest at Raisan (4,000 ft.) on 21st May and saw a pair collecting hair from a donkey's back on 18th June. Several nests were found at Dharmsala in April.

The Jackdaw—*Colœus monedula collaris* (Drummond).

The account of the distribution of the Jackdaw in the 1st edition of the Fauna of B. I. Birds, Vol. I., p. 23, is singularly misleading. It is there given as follows:—"Kashmir and the N.-W. Punjab. According to Hume the Jackdaw is in winter numerous near the foot of the hills and has been found as far east as Umballa, and south to Ferozepore, Jhelum and Kalabagh, and it extends into the Dera Ghazi Khan District. It appears to be resident in Kashmir and as far east as the Valley of the Beas throughout which tract it breeds freely."

To take the breeding range first, so far as we are concerned with it. The Jackdaw appears to breed within a very limited area in Kashmir; it is most abundant and familiar in the vale of Kashmir proper, that is to say the wonderful plain, 5,000 feet in elevation above the sea, about Baramulla, Srinagar and Islamabad. It extends a small distance up the Valleys around the Vale but does not cross the mountain barrier between Baramulla and Murree on the one side, or into the Indus Valley on the other side. Even as close as Dras, Ludlow chronicles the occurrence of a pair by the Rest House on 15th April 1919 as remarkable (Jour. B.N.H.S., xxvii., 141). In the whole area north of the line formed by the Indus and Gilgit Rivers right away to Kashgar the Jackdaw is a winter visitor or passage migrant only.

As regards Kishtwar, Zaskar, Rupshu, and Chamba, my information is only negative: I have found no evidence that it breeds at all in this area, beyond the assumption by Hume that it must do so as it breeds both in

Kashmir and the Beas Valley. By the Beas Valley Hume clearly means Kulu. It should be noted however that Hume's own words are (N. & E., 2nd ed., I, 13.) "I only know positively of Jackdaws breeding in one district within our limits, *viz.*, Cashmere ; but I have seen it in the hills in summer as far east as the Valley of the Beas and it must breed everywhere in suitable localities between the two." He does not state whether he saw a single bird or many. I have three times been along the Beas Valley in Kulu in summer and have also traversed the whole of the trade route in Lahul, from the Rohtang Pass to the foot of the Baralacha, without seeing a single Jackdaw. There is also the negative evidence that the Jackdaw, which is so common about Rawalpindi and Jhelum south of its Cashmere breeding ground, does not appear at all in the Kangra Valley where supposed Kulu breeding birds should debouch in winter. In my opinion therefore there is as yet no evidence that the Jackdaw ever breeds within Punjab territory. As a winter visitor it is common; but in this respect its range is more limited that the wording of the Fauna description would lead one to suppose, and more in accordance with what one would expect from a topical study of its breeding areas.

Its main stronghold is undoubtedly the Rawalpindi and Jhelum districts where it is common and usually found in company with the vast flights of Rooks which spend the winter about the neighbourhood of the Cantonments of Rawalpindi and Jhelum. At Jhelum in the winter of 1913-1914 I found that the Jackdaws first arrived about the middle of October, becoming common by the end of the month, and that they remained until the end of February ; a few birds only staying over into March. There is probably however, as in the case of the Rook, a good deal of variation in the numbers of the Jackdaws and in their dates of movement.

North of Rawalpindi about Campbellpore, Jones (Jour. B.N.H.S., xxvii., 795) says that he occasionally saw it flying over at considerable heights, often in company with Rooks.

There is no published record for Gujrat and Sialkot, but I saw small numbers about Gujranwala in the last week of December 1913. Currie (Jour. B.N.H.S., xxiv., p 561) records large flocks with Rooks at Atari near Lahore in January.

I cannot find Hume's authority for his statement that the Jackdaw has been found at Amballa and Ferozepore ; he doubtless verified his information but it is within my knowledge that many Europeans mistake *Corvus splendens* for a Jackdaw; in any case such occurrences would be very unusual.

His south-western localities of Kala Bagh and Dera Ghazi Khan fall into a different category. It is fully established by Whitehead and Magrath (Ibis, 1909-104 : Jour. B.N.H.S., xix., 256) that the Jackdaw is a winter visitor to the Kohat and Bannu Districts, and Hume states (Ibis, 1871, 403) that it is common at Murdan in winter, and various observers have established its arrival in winter about Quetta, though there apparently in very small and irregular numbers. It is, therefore, in no way surprising that the last outskirts of this west to easterly migration from the Persian and Afghan breeding ground, as opposed to the north to south migration from the Kashmir Valley to the Rawalpindi Jhelum area, should reach Kalabagh and Dera Ghazi Khan. Here the Indus seems to form a very clearly marked boundary and there is no record from the east of it.

One interesting point remains to be noted. Several observers have apparently established the fact that early in the winter the Jackdaw is usually found mixed up with Rooks; whereas after Christmas the tendency is for Jackdaws to form into separate flocks, often of considerable size.

This is doubtless due to the first stirrings of the migratory impulse, and the fact that the Rooks and Jackdaws have to leave for very different destinations.

In the Vale of Cashmere the majority of eggs are found in May.

The Himalayan Tree-Pie—*Dendrocitta sinensis himalayensis* (Blyth).

This species is as yet only known to occur in any numbers in the extreme north-east of the Punjab in the Himalayas about Simla ; from here it has been recorded by several observers. Beavan (Ibis, 1868, 166) states that it is not uncommon about Simla. Tytler (Ibis, 1868) says that it was common in the valleys in June and up to 5,000 ft. Stoliczka (J.A.S.B., xxxvii.) says that it is found in the lower hills from 2,000-5,000 ft. and occasionally up to 7,000 ft. and he procured it at Koteghar in winter. Jones states (Jour. B.N.H.S., xxiv., 602) that it is fairly common at Simla near cultivation with plenty of dense forest in the vicinity. The collection of the Bombay N. H. Society contains from Simla two males obtained in June and July 1886 respectively by Capt. Anderson and a female shot on 30th July 1911 by Mr. P. L. Dodsworth.

I obtained 2 specimens from a family party at Urla, 4,000 feet, Mandi State, on 3rd August 1922.

The Tweeddale collection contains a specimen labelled as obtained at Murree, and this locality is perhaps correctly given (though no recent observer has recorded the bird in this neighbourhood), as Stoliczka says (J.A.S.B., xxxvii., 1868) that it occurs in Southern Kashmir, and Colonel Ward has noted (Jour., B.N.H.S., xvii., p. 109) that a specimen was obtained in the Vale of Kashmir in February 1905.

It is presumably a resident species changing its levels according to season.

According to Jones it lays from the end of May till the middle of June.

The Wandering Tree Pie—*Dendrocitta vagabunda pallida* (Blyth).

The Wandering Tree-Pie is found throughout the whole of the Punjab plain and in the Himalayan foot hills up to about 4,000 ft. It is most abundant in the Central and Eastern Punjab, as about Amballa, Hansi and Jullundur, and becomes somewhat scarce in the semi-desert regions of the south-western Punjab. In the north-western plateau it again becomes scarce except in the hill jungles of the Salt Range and the Kala Chitta. Throughout the Himalayan foothills it is fairly common.

I have not been able to detect the slightest sign of its being any thing but a resident species within our area, but it is worthy of note that Whitehead records (Ibis, 1909) that it is a common winter visitor to Kohat, arriving early in September and leaving about mid April, only a few birds remaining to nest in the Miranzai Valley.

At Lahore according to Currie (Jour., B.N.H.S., xxiv., 561) it breeds from March to June but chiefly in April. About Hansie, Blewitt recorded (N. & E., 2nd ed., I, 20) several nests in the latter half of April, May and the early part of June. I find no other records of its breeding in the Punjab and personally I have never succeeded in taking eggs though I found new nests at Hansi on 5th June and Hissar on 14th June.

The Yellow-billed Blue Magpie—*Urocissa flavirostris cucullata* (Gould).

The type specimen of this race in the Gould collection in the British Museum came from Kulu.

In Simla the Yellow-billed Magpie is very scarce and is replaced by the Red-billed Magpie. Beavan records (Ibis, 1868, 166) a specimen brought in by his shikari and states it was the only one he ever saw there. Jones (Jour. B. N. H. S.) says that he never observed it closer than Jangi in Mandi State across the Sutlej.

According to Hume it may be found behind Mashobra (S. F., viii., 447) and there he says both species may be found in the same dell. At Koteghar it is apparently not uncommon (Lahore to Yarkand, 243).

I have no information about Rampur-Bashahr, but in Lahul and Spiti it is not found. It is abundant throughout Kulu and Saraj and along the Outer Himalayas generally of the North-Eastern Punjab into Chamba It then again appears in the North-Western Punjab about Murree where the Outer Himalayas re-enter the province for a short distance.

It is one of the familiar birds of the hill stations of Dalhousie, Murree and the Galis.

This Magpie is very strictly confined to the mountains. Its summer range lies between roughly 5,500 ft. and 9,000 ft. and in winter it moves somewhat lower to a zone between 4,000 and 7,000 ft., few stragglers arriving as low as 3,500 ft. While strictly speaking a bird of heavy forest, Evergreen or Conifer, it moves freely into open cultivation or bare hillsides.

The breeding season proper is in May and June ; Marshall records (N. & E., 2nd ed., I., 16) finding fresh eggs as late as 15th August.

The Red-billed Blue Magpie—*Urocissa erythrorhyncha occipitalis* (Blyth).

This Blue Magpie is a common bird in the Himalayas from the Jumna to Nepal and extends west of the Jumna into the Punjab area as far as the Sutlej River in the Outer Himalayas about Simla. There is but little on record regarding it within the Punjab boundaries.

Jones states (Jour. B. N. H. S., xxvi., 601) that it is common in the lower valleys about Simla frequenting and breeding in the cultivated areas. Hume says (N. & E., 2nd ed., I., 14) that it breeds sparingly about Simla and Koteghar and he also remarks (S. F., viii., 447) that it may be found behind Mashobra. Beavan records (Ibis, 1868, 165) that he obtained a specimen at Simla on 15th June 1866 and Tytler in his account of a march from Simla to Mussoorie in June (Ibis, 1868) says that he found it common at all heights in small flocks.

Stoliczka says that it is common along the Sutlej valley (J. A. S. B., xxxvii.).

According to Jones it lays three to six eggs in the end of April and May.

The Large Spotted Nutcraker—*Nucifraga multipunctata* (Gould).

The range of this Nutcracker is given in the 1st edition of the Fauna B.I., I,, 82 as "Kashmir and the Himalayas to Kumaon. Stoliczka found this species tolerably common in the pine and cedar forests near Kistwar and Budrawar. Biddulph remarks that it is common at all times in Gilgit above 8,000 ft., and there are specimens in the British Museum from various localities from Murree to Kumaon". Hartert (Vog. Pal. Fauna, I., 28) merely gives the range as Kashmir and the western Himalayas to Kumaon at heights over 8,000 ft., whereas he gives the range of *N. e. hemispila* as the Himalayas from the Sutlej Valley to Butan. The Type locality of the latter is given as 'Himalayas' and of the former as ? Simla. I have not been able personally to examine the specimens in the British Museum on which this given distribution of *N. multipunctata* is based, but there is a later extension of its range to a southern Tibetan locality (Bailey, Jour. B. N. H. S., xxiv., 75) so there is no apparent reason to doubt the correctness of the statement in the Fauna ; under the circumstances as the range of these two western Nutcrackers over lap there is no option but to treat them as belonging to separate species, and not as two sub-species of *caryocatactes.* I therefore follow Stuart Baker's Hand List in treating *hemispila* as a sub-species of *caryocatactes* and *multipunctata* as a separate species. It should be noted however that Hartert (Add. and Corrig., Vog. Pal. Fauna, 2029) would seem to accept *hemispila* as a separate species with races. Further information as to the distribution of these two Himalayan Nutcrackers is therefore badly needed.

There is no doubt that *N. multipunctata* is in the main resident of an area west of the range of *N. c. hemispila.* It appears to be generally common in those portions of Kashmir which being truly Himalayan in character contain the necessary large pine-forests. Stoliczka (as quoted above) says that it is tolerably common in the pine and cedar forests near Kishtwar and Budrawar and his collection included a specimen from Gaora (Ibis. 1868). He later obtained 3 specimens at Gaganghir on August 9th, 1873 (Second Yarkand Mission Report, 21). Ward (Jour. B.N.H.S., xvii., p. 109) says "Common in the larger forests. Breeds, from May to July from 8,000-10,000 ft." Henderson (Lahore to Yarkand, 239) says "Common in the Valley of Kashmir in October; it was met with at Sanamarg, below Baltal, and as low as Gond". Richmond (Proc. U. S. Nat. Mus., xviii) catalogues 8 adult specimens collected by Dr. Abbott. Three of these were obtained in Western Kashmir at 8,000-9,000 ft., 5-7th July, three in the Now-boog Valley, Eastern Kashmir, 7,000 ft., 16th August; one at 8,000 ft., Pir Punjab range, 30th August; and one at 9,000 ft., Sind Valley, 8th November. Biddulph (S. F. IX., 342) states that it is common at all times above 8,000 ft. in the forests of Gilgit.

In Chitral it appears to be less common. Fulton (Jour. B. N H. S., xvi., 46) only obtained a single specimen and saw no others. Perreau (Jour., B. N. H. S., xix., p. 902) received a specimen from Utzen at 7,500 ft., and saw two about the same height in the Drosh Nala in June. It is found in the Hazara District. Magrath states (Jour., B. N. H. S., xviii., p. 285), that he heard one about the middle of June at Thandiani; while about Nathia Gali in 1913 I found it common and much in evidence both in July and September.

Further west again we have Whitehead's evidence (Ibis., 1909, 106) that it occurs sparingly amongst the conifers of the Sufed Koh.

All the above records refer to areas outside the Punjab boundary though it is clear from a consideration of them that the bird may be expected to occur in winter at least in the Murree Hills. The species however finds a place in our list in virtue of Stoliczka's record (J. A. S. B., xxxii.) that he obtained a specimen on an elevated point beyond Bilaspur in October 1865.*

The Himalayan Nutcraker—*Nucifraga caryocatactes hemispila* (Vig.)

The Himalayan Nutcracker is a common bird throughout the Pine forests which lie to the north of Simla at elevations from 6,000 to 9,000 feet. In particular Mahasoo, Fagoo, Baghi, Narkundah, and Koteghar may be quoted as favourite localities for this bird. The exact limits of its range are uncertain but according to Stoliczka (J. A. S. B., xxxvii.) it is common throughout the Sutlej Valley up to the limit of trees as far as Chini. It is a permanent resident but in winter it tends to move a little lower in altitude, like most Himalayan species, and to approach closer to Simla where it is not usually found. I have there observed it common at Kufri as early as November 9th, and Beavan long ago recorded (Ibis, 1868, 166) that he once saw a pair in the gardens at Annandale. Though he gives no date for this record it was doubtless in winter as he goes on to observe " They probably visit the woods there during the winter months when driven down by heavy snow."

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* Since the above account was written I have received a specimen from the Thakur of Lahul obtained in the Chandra Bhaga Valley, lower Lahur, where a few pairs are said to occur.

Further north it is found in Kulu. The collection of the Bombay N. H. Society contains specimens obtained by General Osborn at Naggar (♂ 1-10-1903; ♂ 8-9-1903; ♀ 1-10-1903), and my own collection contains a bird which I shot from a party at about 8,000 feet on the northern slope of the Bhubu Pass on 7th July 1910. In July of this last year (1921) I heard the call of this species about the same locality. Hume has also recorded (N. & E., 2nd ed., 1-30) that his people found young below the Jelauri Pass in April. It apparently does not occur in Lahul or Spiti.

To the west again its range is uncertain. It is not uncommon at Dalhousie where A. H. Marshall, Indian Police, informs me that he shot a specimen on 21st August 1917. I saw one individual there on the Upper Bakrota Mall 7,000 feet on 2nd September 1915. Mr. N. B. Kinnear informs me that he also met with it in Dalhousie in October 1917 and he remarks that in his opinion it is probably commoner than is generally supposed.

At Dharmsala however it has not yet been recorded. It is not in Hingston's list (Jour. B.N.H.S., xxvii., p. 555) and up to the present I have failed to meet with it there or anywhere along the southern slope of the Duala Dar or first snowy range from the Chamba border above Shahpur east to Jhatingri.

Very little is accurately known about the breeding season. Jones obtained a nest with two young about five days old, and an addled egg on 10th March 1917 at 7,500 feet near Simla (Jour. B.N.H.S., xxvi., 602). Hume obtained nearly full-fledged young near Fagoo early in May (N. & E., 2nd ed., 1-30) and records his opinion that they must lay in March or early in April.

The Black-throated Jay—*Laletris lanceolatus* (Vig.).

The Black-throated Jay is a very abundant and familiar species on the southern slope of the Outer Himalayas in the north-east of the Province from Dalhousie and Bakloh to Simla and the boundary of the Punjab. Here it breeds from about 5,000 to 8,000 feet, and while some individuals remain at this altitude during the winter months the majority appear to collect into flocks and move down to the zone between 3,500 and 5,000 feet in the months of January and February.

It certainly occurs north of this outer or first snowy range as I met with single examples in Kulu on the 18th June at Jaggat Sukh (6,000 feet) and on the 29th June at Larji on the Beas (3,500 feet), but there appears to be no information on record as to its range or degree of abundance in this area. It does not occur in Lahul, or in Spiti. Stoliczka says that it is more confined to the lower ranges close to Simla and does not extend far into the interior although common at Koteghar in winter.

In the north-west of the Province it again appears with the Himalayan ranges about Murree and the Galis and there too it is abundant from 5,000 to 8,000 feet. It presumably moves down in winter here, as in the eastern area, but records are silent on this point.

It is of interest to note that the species is found in some portion at least, of the Suleman hills west of our area, as Whitehead records (Ibis, 1909, 105) that it is a resident from about 5,000 to 8,000 feet on the Samana and in the Kurram Valley, a few birds occasionally reaching the plains of

Kohat. It has not however yet been obtained in any portion of the Punjab plains and is not to be expected there even as a straggler, as in winter none appear to reach even the foot-hills proper.

The breeding season extends from the middle of April to the end of June.

The Himalayan Jay—*Garrulus glandarius bispecularis* (Vig.).

This Himalayan race of the common European Jay appears to have much the same distribution in the Punjab Province as *Laletris lanceolatus* along the Outer Himalayan range. Stoliczka however (J. A. S. B., xxxvii.) says that in the Sutlej Valley it occurs much further north and more into the interior of the hills, being occasionally seen about Chini. I find no record of the species from Chamba, Kulu, Lahul, or Spiti. Throughout its range it is however markedly less numerous than the Black-throated Jay. It appears to be found at the same elevations as that bird, and to be subject to the same seasonal movements, both species indeed being often found in company during the winter months.

The breeding season extends from March till June, the majority of eggs being found in April.

The Red-billed Chough—*Pyrrhocorax pyrrhocorax* (L.).

In spite of Jerdon's statement that the Chough visits the plains of the Punjab in winter in company with the Jackdaws it may be safely said that the species is only found in the mountains of the north-east corner of our area.

Its main stronghold is of course on the extreme border of Punjab territory. In Lahul in May and June I found it common though less abundant than the Alpine Chough, throughout the Chandra and Bhaga Valleys from the Rohtang Pass up to near Patseo. It was most common in the Valley of the Chandra near Khoksar and was scarce beyond Kyelang. It did not venture apparently much above 13,000 ft. but kept to the valleys from 10,000-12,000 ft. They were then in pairs and some of these appeared to have young in the cliffs. In Spiti, according to Stoliczka (J. A. S. B., xxxvii.), it is also common and generally observed in summer from 13,000-15,000 ft. It also breeds in some portions of Kulu for, on my way into Lahul, I found it fairly common from the Beas tunnel at 8,000 ft. below Kothi, right up to the top of the Rohtang Pass. The birds were then in pairs feeding about the Alpine pastures and some were certainly breeding both in the Beas tunnel and in the cliffs above the road at Rahla Rest House. In the latter spot I actually saw a nest in the face of the cliff but in spite of my utmost endeavours the site proved quite inaccessible. Mr. H. Branford of Mirzapur informed me that he saw a few Choughs over the snow in the Malasu Nullah on 8th June 1919. Beavan records, on the authority of Col. Gott (Ibis, 1867, 137), that it occurs about the Jalauri Pass.

It apparently also breeds in Bashahr, for Stoliczka says that it "is rare in summer in the neighbourhood of Chini and only on elevations of and above 11,000 ft.; it is however more common in these parts during the cold weather." Von Pilzelu comments on a female obtained by Stoliczka at Rogi (Ibis, 1868).

I suspect that during winter the Chough must descend right into the Kulu Valley but there is no record on the point.

The Chough is also found on the Duala Dar or first snowy range from Dharmsala to Palampur. Of Dharmsala, Hingston writes : " A common and noisy resident of the snow line. Keeps almost exclusively to the Alpine pastures. Moves slightly up and down the slope in accordance with the change of season. In winter may descend as low as 8,000 ft., in summer ascends as high as 14,000 or 15,000 ft." (Jour. B. N. H. S., xxvii., 555). My observations about the same locality confirm the above account except that on occasions in winter the flocks move down as low at 6,000 ft., and in January and February of this year (1922), occasional parties would fly over my garden at Lower Dharmsala (which is situated at 4,000 ft.) at a great height but coming from the south as if they had been down in the Kangra Valley. During one absence of mine from the station in the second half of February, according to an orderly who volunteered the statement, they actually visited my garden.

The eggs do not appear to have been taken yet in British Territory. In Ladakh, Ludlow took a clutch of 3 incubated eggs at 13,000 ft. on 14th May and found young still in the nest in Leh on 13th June.

The Alpine Chough—*Pyrrhocorax graculus* (L.).

Like the last species the Alpine Chough is only found in the Punjab in the mountainous area of the north-east.

The main stronghold of this species is Lahul where it is one of the commonest and most distinctive birds in summer, being found throughout the country from 10,000 feet at river level up to about 13,000 feet. It is there much more abundant than the Red-billed species, and is indeed compared by Stoliczka to the House Crow of the plains for its noisy boldness in the vicinity of human haunts. In Spiti it appears to be equally common according to Stoliczka's account and he states (J. A. S. B., xxxvii.) that it moves lower down in winter and is then especially common in Kulu. It does not appear to be found in Kulu in summer.

The only other locality in our area for which there is a record is the Duala Dar range behind Dharmsala. Here according to Hingston (Jour. B. N. H. S., xxvii., 555) it is "resident on the snow line. Less common than the Red-billed species. Both these Choughs haunt the same elevation, move up and down the slope within the same altitudinal limits (*i.e.*, down to 8,000 ft. in winter : in summer up to 14,000-15,000 feet) and intermingle in a common flock." I have however failed to meet with the Alpine Chough in this locality myself.

The eggs do not appear to have been found as yet in British limits. From my observations on the species in Lahul I would presume that the majority lay there in May and June. I left that country on 15th June and by then had seen no young bird on the wing although young in the nest were certainly heard in a cliff beyond Kyelang. The organs of six birds skinned were in different stages of enlargement but some were in breeding condition.

A JOURNEY TO SIAM.

THE ROAD CROSSES A STREAM.

A KAREN VILLAGE.

A JOURNEY TO SIAM AND BACK.

BY

MAJOR C. H. STOCKLEY, D.S.O.

(*With 3 plates*).

It was the curious shape of the horns of a Schomburgh's Deer hanging on the walls of the British Museum which first attracted me to Siam. Their numerous points and general appearance were so unlike any other big game trophy that, since, like most other men, I already associated Siam with strange things in the way of white elephants and twins, it was obvious that here was a country which would well repay investigation. A journey to the Lower Salween and a small portion of the Siamese frontier in the spring of 1914, confirmed me in my decision to visit that country as soon as possible, but the war put an end to the trip I had arranged for 1915, and it was not till January 1920 that I found myself definitely committed to the enterprise.

Enquiries from the British Museum had elicited little information as to the habitat of Schomburgh's Deer: it was only known by purchased heads, and had never been seen by a white man; while its habitat was supposed to be as given in Rowland Ward's "Records of Big Game," which stated that the nearest point at which I might expect to find *Rucervus schomburghi*, was the vicinity of Paknampo, at the junction of the Meping and Menam rivers. Accordingly I decided to make my way across country from Moulmein to Raheng, on the Meping, *via* the Ta'ok Plateau; then travel down the Meping, and make further enquiries there. The country I should traverse was bound to be rich in zoological interest, and I should probably pick up a little big game.

On the 24th January 1920 I left Moulmein in an Irrawadi Flotilla Company's launch for Gyundo, which lies 42 miles up the Gyaing river. A dull day's journey up the muddy, forest-bordered stream brought me to Gyundo in the evening; and in the morning, the heavy baggage having gone on overnight by bullock cart, a much dilapidated Ford car took us the 16 miles to Kawkareik, the residence of a sub-divisional officer, and the last administrative post I should see.

I found I would have to wait a day or two in Kawkareik for my elephants to be collected, so arranged a few beats for "gyi" (as the Barking Deer is called in Burma), or anything else that might turn up. The country round Kawkareik is mostly low hills covered with forest of medium height, the trees being mixed bamboo and deciduous. A few miles to the East rises to over 4,000 ft. in parts the wall of the Dawna Range, clothed from base to summit in dense forest, of which the trees seem to be larger the higher one goes: this forest is mostly evergreen from 2,000 ft. upwards.

The first day's efforts produced one 'gyi' and a fine civet cat (*Viverra zibetha*) which came out almost at my feet. Unfortunately I forgot that I had a lethal bullet in my right barrel, and knocked his head about very badly. His skin measured an inch over four feet, quite the biggest specimen I have seen. Next day another 'gyi', a few jungle fowl, and a magnificent peacock exactly 100 inches long, were bagged.

There was still no news of my elephants, so I had one more morning's outing which, though unprofitable in the matter of big game, was decidedly amusing. We found a large pool in the jungle where a flock of Larger Whistling Teal were resting. I knocked down three birds as they rose, but the expenditure of five more cartridges and the efforts of three men wading in the water, which was only about three-foot deep, only brought two of them to bag. The third vanished from under a Burman's hand in absolutely open water and was not seen again. These duck beat even pochard in evading capture when wounded.

During the last beat of the morning I was standing at the foot of a small hill, and some jungle-fowl ran by me through the bushes up the slope: shortly arose the sounds of struggling and flapping wings; and, on investigation, I found a neat little bamboo fence built diagonally uphill furnished with small openings every five yards; each of these being well guarded with horsehair nooses. In one noose a fine jungle-cock was struggling. The fence was only about 15 inches high, but jungle-fowl will always run rather than fly, and many of them are taken in these contrivances.

All the Barking Deer I shot near Kawkareik were larger and lighter-coloured than those I shot in Upper Burma, and this was characteristic of all those I met with later in my journey, whether in Tenasserim or Siam, except in the case of two individuals seen on the Ta'ok Plateau, which I took to be Tenasserim Muntjac (*Muntiacus feæ*).

The most conspicuous birds were the Racket-tailed Drongos, both large and lesser, and they were to be seen everywhere but in the heart of the forest, nearly always in pairs. They were very early risers, and their rather musical metallic whistles sounded every morning with the first flush of dawn, as they climbed about some flowering trees, probing the blossoms for insects. Owlets were met with at all times of the day, particularly on the main road, and a brown nightjar with a conspicuously rufous tail was frequently flushed in the open forest tracts. This nightjar was also very common later on at the edge of the forest on the Ta'ok Plateau. I saw no pheasants at all near Kawkareik, and fancy the local poachers are the reason of that.

On return to the forest bungalow on the 28th, I found a telegram saying that my elephants were ready at Kya-in, about 40 miles from Kawkareik; so I sent orders for them to meet me at Lampha, a forest hut from which I proposed going up to the Ta'ok Plateau which lay about 24 miles from Kawkareik, and myself left at midday next day with bullock carts for Lampha, camping nine miles out after a dull march across flat rice fields.

Our next march was the first of real forest travelling, for our road lay through continuous jungle; bamboo and large trees in about equal quantities. About 8 o'clock we were passing through a tract of grand trees shading deep pools in a boulder-strewn nullah, when suddenly every bird in the forest began to call. The harsh cackle of Woodpeckers mingled with the loud croaks of the Great Hornbills; Laughing Thrushes and Scimitar Babblers burst into spasms of ribald cachinnations, vying with the screaming of flocks of Rose-breasted and Blossom-headed Paroquets; Drongos whistled and Jungle fowl crowed, while every small bird added his share to the riot. Twice later on I experienced the same sudden outbreak, and in each case it lasted about twenty minutes; then subsiding to the ordinary volume of jungle noises.

We crossed several of these nullahs or "choungs", and it was obvious that they would form a considerable obstacle to marching in the rains. They invariably held two or three cormorants, both little and great species. All these "choungs" flowed down from the Dawna Range on the east to join the Huangdarau, which flows northwards along the foot of the range to join the Gyaing.

About eleven o'clock we emerged suddenly from the forest into full view of a sheet of shallow water, about a mile square in extent, which was crowded with waterfowl. Round the margin, in some cases twenty yards from shore, White-breasted Waterhens walked fearlessly on the weeds, contrary to their usual skulking habits, while Jacanas ran about the broad-leaved plants in the centre. Innumerable snow-white egrets, mostly of the greater species, stood marshalled on the bank and on old bamboo rails which stood half out of the water, and a score of dark grey blots indicated the herons sunk thigh deep at their ever patient fishing. A Stone Curlew stood motionless on a patch of turf, while a Black-tailed Godwit prospected the margin near by. On the open water in the centre floated a flock of Lesser Whistling Teal. As we approached, the ubiquitous Burmese Lapwings rose wheeling and protesting with their tri-syllabic "tee-tee-du" which gives them their Burmese name, and which is a syllable short of the "did-he-do-it" of their Indian cousins. Kingfishers of course there were in plenty, Common and White-breasted sitting on nearly every old bamboo stem while the Pied hovered and dropped with loud "plops" into the water. But there was one I had not seen before. A red blot on a shady overhanging bough caught my eye, and a quiet approach brought me within five yards of my first Ruddy Kingfisher as he sat lost in reminiscence of his last fish.

We skirted the margin, while a pair of ospreys screamed from a lofty wood-oil tree, and entered the forest again past a small village, where I bought some fresh cocoanuts and where I saw two fine specimens of *Eulepis arja* settled on a bullock's skull which still retained a nasty savour. These beautiful butterflies with their large silvery-white patches harmonising with the delicate chestnut of their undersides, have a predilection for such noisome feeding places, but on this occasion they did not pay the penalty for I tried to include them both in one sweep of the met and failed to catch either.

Half a mile on, and the gleam of water through the trees on the right of the road attracted me and a furlong's walk in that direction brought me out on the margin of the Huangdarau, which the very indifferent map I carried showed to be a couple of miles away. Here it was about one hundred yards wide, flowing placid and gentle between high reed-fringed banks, the dull-green water about four feet deep. The wood-oil trees were particularly fine about here, towering to 200 feet, or more in some cases, without a branch for the first 150 feet; this characteristic has earned them their Burmese name of "myouk kyar" meaning too smooth for a monkey to climb. Their English name is derived from the fact that they provide a flow of oil, which is used largely in waterproofing boats, oiling roofs to keep out the rain, and other useful ways. It is extracted by cutting an alcove-shaped hollow in the trunk about four feet from the ground ; a fire is then lighted in the hollow and left to burn for a day. This acts as an irritant and promotes a flow of oil, which accumulates in the base of the hollow and is collected periodically by the owner. It is a very wasteful system, as trees are often left with the fire burning, so that they are destroyed ; and the tree is eventually killed by it in any case, if the process is persisted in. Some check should be put on the practice, as the trees are magnificent when fully grown ; but it is very difficult to effect, as the native oil-collectors wander very far afield in pursuance of their wants.

Another three miles through dense forest with the bamboos brushing the carts on both sides in many places, brought us to a clear twenty-yard wide stream with a foot of water rippling over its stoney bed ; on the far side of this could be seen a clearing in which stood the Lampha forest hut, while a few of the village roofs were visible down-stream through the dense foliage. An untimely koel shrieked as we entered the compound and continued to do so as we stowed the baggage under the pile-built hut; so that I set out to slay him while tiffin was being prepared, and nearly murdered a Hair-crested Drongo which flew out of the same tree at the crucial moment; the miscreant escaping in the confusion.

After lunch I interviewed the latest-joined of my staff,—a square-headed individual with an upstanding crop of hair cut in bootbrush fashion. He had come up to me as I was leaving Kawkareik, asked whether I was going to the Ta'ok Plateau, and, on receiving an affirmative answer, had declared his intention of accompanying me there and stated that he would join me at Lampha.

Now he had arrived, and told me that his name was Maung'U and that he was half Burman, half Siamese, and could speak both languages as well as Karenni. As he also owned a most engaging twinkle in his eye and stated that he knew where the bison were to be found on the Ta'ok Plateau, I took him on, and we were sorry to part four months later on my return.

He proposed that we should try for a 'gyi' that evening and we set out at about four o'clock. Maung'U was not a great success, as he made a noise like a buffalo and attempted to call buck 'gyi' with most excruciating sounds made with the aid of a leaf, this in spite of the fact that it was not the rutting season; accordingly I was not much impressed with his abilities as a shikari.

About 1 a.m. that night I was awakened by a tremendous crash, as some forest giant fell. Immediately the jungle broke into sound. Gibbons whooped and jungle fowl crowed, while ringing barks showed how numerous were the 'gyi' in the neighbourhood. The noise lasted about five minutes and ceased as suddenly as it had begun. I noticed on similar occasions later on, that the jungle-fowl always crowed when a tree fell at night, but that they were not usually joined by other animals unless it were bright moonlight. Sambhar also occasionally called on these events.

Next morning was devoted to beating for sambhar, but we saw none but hinds; I hit and lost a beautiful cock Silver Pheasant (*Gennaeus lineatus*) which I badly wanted as a specimen.

A curious incident occurred with a 'gyi'. We drove him out of a clump of young cane, and I failed to get a shot. I then sat down where I was to have my lunch, and the beaters also sat down in groups all round me. Five minutes later there was a scurry of hoofs, and the buck dashed right into the middle of us, gave one or two frightened springs from side to side, then bolted into the cane brake from which he had originally come, clearing my feet in his stride. The whole incident was over so quickly that I stared at the buck, armed only with a tin of sardines, and quite forgot to reach for the rifle which was lying by my side. I suppose that the buck was so badly frightened when first driven out, that he had run in a circle until he found himself again close to his harbourage, and had made a bee-line for it.

All the sambhar stags we had put up in the course of the morning broke back out of the beat, and the only shot I fired was at a large wild boar, which got away badly wounded into a tangle of thorn and creeper so dense that it was hopeless to try and get him out of it.

This boar, and others I saw later both in Burma and Siam, were of the black, heavily-crested, Tenasserim species. They appeared to me like large editions of the village pigs, and I suspect that they were not truly wild but feral. It is possible, of course, that the village pigs are direct descendants of the wild ones, and retain all their characteristics, but the wild pig of Tenasserim is quite different to those I shot in Upper Burma (which appeared identical with the Indian wild boar), and it would be most interesting to know where the dividing line of the two species exactly occurs; also if they overlap.

During one beat a very tame Orange-headed Ground Thrush hopped round my feet; and a little later, on approaching a pool in the middle of the forest, a splash of bright red caught my eye from a tree near the edge. This proved to be the bill of a Stork-billed Kingfisher; a handsome enough bird who seems to have lost his original issue in the bill line, and to have acquired an enormous misfit in red sealing wax to replace it.

This pool was a regular specimen aviary for waders, for I saw one each of the following patrolling its margin or standing in the water:—Black-necked Stork, Large Egret, Small Egret, Paddy-bird, Common Sandpiper and Black-tailed Godwit.

I have forgotten to mention the mynas. These formed a large proportion of the bird population round the forest hut, and were of several species,—Pied, Jungle, Common and Grey-headed, while I also saw two Siamese Mynas, with their curious frontal fringe, which I was to see in plenty further on. The Pied Mynas seemed the most plentiful, and used to come in riding on the backs of the buffaloes in the evening, often sharing a steed with a Cattle Egret.

I did little with the butterfly net. The commoner species were plentiful, such as *Papilio aristolochiæ* and *Danais plexippus*, while *Zeltus etolus* trailed its fluttering white tails along every jungle path. In the depths of the forest only the sober brown *Satyridæ* were to be found, and I was there usually too much occupied with larger game to pay them much attention.

The elephants turned up on the evening of February 1st, two fair-sized and one small. They were all equipped with the Karen "kah"; which, though admirable for packing a load of rice, is a most difficult thing to use for packing mixed gear. A "kah" is nothing but a large basket made of wooden slats or wicker-work supported by a cross frame of curved wood kept from direct contact with the back of the elephant by pads or mats.

These baskets have very little capacity for such things as store boxes or tents. It was evidently going to be a difficult problem getting all my kit on to the backs of my three pachyderms, but I solved it by having small platforms built out behind the "kahs" from strips of bamboo. The drivers made these platforms very neatly, using no other tools than their dahs, the long sword-knife which all Burmans carry, and with which they are extremely expert.

I took some time adjusting the loads next morning, so we did not get away from Lampha till 8 o'clock. We trekked along the forest road for a couple of miles, then turned eastwards along a jungle path which brought us to a small Karen village, where I picked up an old shikari and his son; both of whom were supposed to know the Ta'ok Plateau.

Thence onwards the upward slope grew steeper and the forest denser, until, at about one o'clock, we halted for the day, as we had come to the last possible camping ground and there was still a long way to go to reach the summit. Camp was pitched on a small flat piece of ground amongst giant bamboos, and above us the track led up a ridge which looked much too steep for any pack animal.

But I had a lot to learn about elephants, and one thing was their amazing capabilities on steep ground, and the ridge seemed to offer them little difficulty when we continued our march at sunrise. Carefully and slowly they zigzagged up the steepest part until they reached the easier grade of the crest: then along this, lifting fallen trees out of the way, breaking off overhanging boughs so that the loads should suffer no damage and occasionally stopping and helping at command to adjust a kah or some portion of its load which had come displaced. They made slow progress, for the fallen trees and overhanging boughs were many, so I went on ahead and sat down by an immense fallen trunk which looked to be a serious obstacle to progress.

While I sat, there came a sudden "churr-r-r-uck" from a gully about twenty yards away, and Maung'U whispered "Yit." It was a call quite distinct from any that I have heard uttered elsewhere by Silver Pheasant, but a careful stalk, although it did not give me a shot, showed me an undoubted cock *Gennaens* as he scuttled away. I heard this type of call several times subsequently in the Thaungyin catchment area, but it altered to a shorter, sharper note when I reached the Meping Valley, and there I also heard a cock pheasant utter a sound rather like the mew of a cat.

Returning to my seat on the log, I was soon joined by a Scarlet Trogon, which settled on a bough within a yard of my head, and seemed quite unconcerned when I moved about freely.

The elephants arrived and surmounted the obstacle, so we walked on again up the greasy, slippery track, which now led entirely through evergreen forest. At a point where a small spring made a large muddy patch at the foot of a great pingado tree, we came suddenly on a covey of eight Green-legged Hill Partridge, which rose like a bursting bomb all round us, and were out of range long before I could change the butterfly-net for the gun. Above this point, for a furlong or more, we trod in the fresh tracks of a tiger, though traces of other mammals were almost entirely absent.

Another hundred yards and a still steeper bit made me sit down for a rest, while I watched the tree-world above me. The first of its denizens to appear was a party of about twenty slender Leaf-eating Monkeys, whose lithe exiguous forms and greenish-grey fur made them hard to distinguish amongst the foliage as they passed overhead. Then a couple of Pied Hornbills arrived, quickly followed by a Black-headed Oriole and a Golden-backed Woodpecker. Then there was a swift rush and a swaying branch high up in a great tree, but I could not make out the newcomer, until a loud mooing coo told me that there was a Green Imperial Pigeon somewhere up there in the leaves. A stealthy approach to try and fill the pot, and then, as I peared upwards trying to make out my bird, there was a rush by a belated monkey and away flew all the birds, the pigeon with them.

Again we plodded up the hill, liberally "larding the lean earth," for it was now half past ten and the sun was quite hot, until suddenly the slope eased, we pushed through a few yards of dense high grass, and emerged on the crest of the very rim of the Ta'ok Plateau. A cool breeze greeted us, and as I sat down to rest it seemed as if we had suddenly arrived in an entirely different country, so great was the contrast between climbing, pent between high walls of forest, and the tremendous prospect which lay before us;—a prospect which included rolling grassy slopes such as I had never expected to see in Lower Burma.

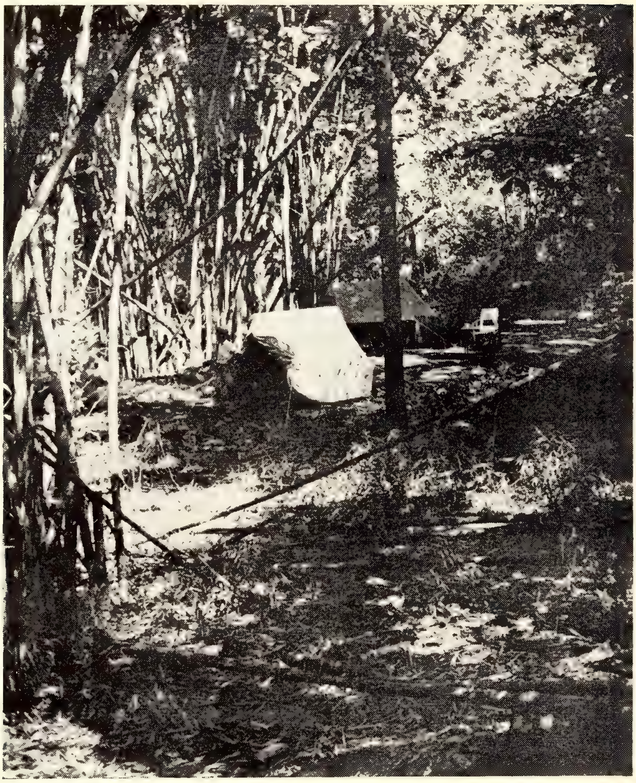
We sat on the top of a ridge above 4,000 feet about sea-level, with a fine view on all sides but the south, where a massive, tree-crested hill shouldered up into the sky a few hundred yards on our right. A long grassy slope fell away eastwards for a thousand feet to meet a wide mass of forest in the hollow, and beyond a lesser hill rose to connect with a rock-crowned giant, which ended abruptly on the north in a granite precipice to which trees clung in scattered clumps and which looked a likely place for serow. A deep forest-filled valley lay on our left, whose far side rose steeply in rocky shelves to where a series of small isolated peaks formed the western crest of the Dawna Range. This valley was traceable

A JOURNEY TO SIAM.

A GYI OR BARKING DEER.

LARGE INDIAN CIVET (*VIVERRA ZIBETHA*).

A JOURNEY TO SIAM.



CAMP IN GIANT BAMBOO.

THE ELEPHANT TESTS EACH PACE WITH HIS TRUNK.

several miles to the eastward, and evidently held the stream which eventually flowed past Lampha.

Far away to the east, rising above another grassy hill, I could see a great dim hogsback which was evidently in Siam, and in all probability the water-parting between the Thaungyin and the Meping. This surmise was afterwards proved correct, with the additional discovery that it also marked the headwaters of the Meklong. This great hogsback is in fact the central and the highest portion of the waterparting, and the true Siamese faunal area begins on its Eastern slopes; the fauna of the Western slopes, which drain into the Meklong (flowing southwards) and the Thaungyin (flowing northwards) being typically Burmese in nature, though Siamese territorially. I may add that the water-parting between the Thaungyin and the Meklong is low and gently graded.

We admired the view for half an hour, and then descended the slope below us to where a fathom-wide brook ran clear over a gravelly bed under arching trees, and, seeing some sun-warmed shingle thick with butterflies, while many old bison tracks shewed on the flat ground beyond, decided that it was obviously the place for lunch.

Amongst the butterflies the map-like markings of two species of *Cyrestis* were most in evidence, but there were also several *Lycœnidae* which looked interesting and a few gorgeous *Papilios* to be seen, so the net was soon busy. The lovely iridescent greens of many *Papilio paris*, which flew in a constant stream up and down the valley, were a joy to the eye.

Soon the " cling-clang-clonk " of the elephant bells came down the hill, and we moved northward along the valley, and crossing a low ridge, re-entered the forest; then, fording the main stream, moved three hundred yards up its left bank and camped on a long narrow flat, which overhung some deep clear pools well stocked with fish up to half a pound.

I had visions of a fish dinner, as I took these fish to be mahseer, but the fish thought otherwise, and definitely declined to have anything to do with the numerous lures I offered them in the course of the next two days; so, as I fancy myself at catching mahseer, I decided that my specific diagnosis must be incorrect.

That evening we went to the grassy hill we had seen to the east, to wait for bison to come out and feed. A long watch resulted in the appearance of a couple of cows, and we had a toilsome walk home in the dark, stumbling over fallen trees and falling down greasy clay slopes in the forest, much to the detriment of clothes, shins and temper.

The next morning was only notable for a thorough soaking by the extraordinar ly heavy dew: it weighed down the waist-high grass, and, as we passed through, we were drenched from head to foot in a few minutes. I also found that shorts were not at all suitable wear for this grass, as it cut my knees freely with its hard siliceous stems, so that they soon resembled a map of a heavily trenched area in France.

We climbed the big hill to the south, and investigated the precipice on its north side which overlooked the camp, but found nothing but old tracks of bison and serow,—few of the latter—none of which were less than five days old; but in a small swamp, where grass and forest met down in the valley, were some great miry footmarks which looked to be more recent traces of bison, and I decided to investigate further in the evening.

Back in camp by ten o'clock, and then a pleasant spell of butterfly hunting, which added some specimens of *Cirrochroa* and *Charaxes* to the bag. *Charaxes* are as evidently built for speed as a racing motor-car, and with the same stream-line body. They are the most vigorous strugglers in a net and knock their beautiful black-veined, brown wings to pieces unless rapidly pinched or removed from it.

Five o'clock found me perched on a rock on the big hill south of camp, while I watched the valleys below. The sun had set some time before, when I spotted, in a small coombe at the edge of the forest, a moving black blot which the glasses showed to be a grand bison bull. There was no time for manœuvring, and I ran straight down hill to the shelter of a ridge, and then directly towards him. Unfortunately there was a deep gully on my side of the ridge, so filled with vegetation that I took some time pushing through it, and, when I reached the crest, the bull had shifted and was not to be seen. I pushed on into the coombe beyond, and found myself in bracken higher than my head, (I am over six foot three) through which progress was only possible along a game run. I forced my way on, hoping to reach a clearer spot, when there was a sudden rush and the head of the bull appeared above the bracken not ten yards away, and making rapid progress in my direction. Whether he really was charging or was merely coming to investigate the noise or the top of my topi, was immaterial : it was obvious that he would almost certainly charge as soon as he found himself right on top of me, and the stiff bracken stems would preclude all chance of dodging. I therefore had a bang at his nose on the chance of dropping him with a lucky shot, and the probability of turning him in any case. He was almost on top of me when I fired, so I flung myself sideways into the bracken and hoped for the best. A tremendous snort and a plunge, then a thunderous rush downhill to the edge of the forest, where a series of crashes receding in the distance was followed by dead silence.

I disentangled myself from the bracken and rose. The bull had swerved downhill a couple of yards from me, and twenty yards along his track was a smear of blood high up on the underside of an overhanging frond. I followed along the trail to the edge of the forest and found two or three more marks in the same position, so that it was obvious that he was hit high up, probably in the face. It was already nearly dark, so it was no good trying to do anything more till next morning, and I stumbled home rather depressed in mind ; for a head shot is usually fatal at once or fails to trouble the beast seriously, and I felt sure that a furrow ploughed along his forehead was all the damage done on this occasion.

Next morning proved this. For three miles along the trail with the blood marks gradually petering out and no sign of a halt or slackening of the bull's pace convinced me that he had suffered little damage ; and when the blood-trail failed altogether, my disappointment at the loss of a fine trophy was much mitigated by relief that I was not leaving him to die of his wounds.

On the way back to camp I shot a Barking Deer, of the same type as I had killed near Kawkareik, and which provided a welcome supply of fresh meat.

Next day we shifted camp three miles to a valley in the heart of the forest on the East side of the main divide, and while the elephants made their ponderous way to the new place, I went round through the jungle with Shwe Gyi Paw, the old Karen hunter, and Maung'U to look for game. We saw nothing but old bison tracks until we turned for camp, when there was a rustle in the undergrowth on top of a slope a few yards away and I saw a Barking Deer slipping through the bushes. He seemed very dark in colour, but I put this down to the shadows until he halted at the top, when it was obvious that he was a great deal darker than any 'gyi' I had ever seen before ; so I had a shot at him. Unfortunately there was a big fallen branch in the way which received the bullet, and he got off unhurt. I was inclined at the time to put him down as a mere colour variation of *Cervulus grandicornis* ; but as I saw on my return journey three months later, not two miles from this same spot, a dark chocolate-coloured Barking Deer which I am sure was a buck *Cervulus feae,* I feel convinced that the animal I saw on this first occasion was also of that species.

About a mile from camp we came suddenly on the tracks of a rhinoceros. They were three or four days old, but nevertheless of considerable interest. We were following them up a little to see if they crossed a fresher trail, when from out of a foot-print, where it was sunk deep in leafy mould, flew a woodcock. I was still wondering at the curious combination of rhinoceros and woodcock, when out of another foot-print, three yards further on, flew another woodcock, almost touching me as it rose. Woodcock are rare in Tenasserim, but have been recorded from there more than once : their being found there is not remarkable when one considers that they are common on the Nilgiris, and a careful search on the Ta'ok Plateau in January and February would probably bring several of these birds to light.

The evening and the morning shoots from this camp produced no results in big game, and the plateau seemed very deficient of animal life on this (eastern) side. On the evening of the 7th we went a long trek to the end of a big bare spur overlooking the main nullah flowing eastward from the plateau ; here also we saw nothing but fresh traces of bear and an endless procession of Green Imperial Pigeon, which passed over our heads, flying westwards, just as the sun was setting.

I had to get on with my journey, and could stay no longer on the plateau, so next morning we started off at sunrise for Ta'ok village which lay in the valley to the east. Across a grassy "kwin", where I shot a Blanford's Button Quail, and then along the flat crest of a ridge, where a couple of Grey-headed Imperial Pigeon delayed me but gave me no opportunity to add them to the specimen box, a couple of miles of alternate evergreen copses and open grassy glades brought us to a small spring where I sat down to await the elephants. Here I was made a fool of by a butterfly. I captured a large *Danaid,* pinched him severely, and, as the collecting case was some distance behind, I placed him in the lining of my hat. On the arrival of the case I took off my hat to transfer him, and he forthwith flew away. These *Danaids* are very tough and take a lot of pinching to disable them. The elephants arrived and I discovered that the orderlies had left the other butterfly net behind in the last camp, and as butterfly nets are not easily replaced in the depths of the forest, I was decidedly annoyed.

We pushed on another couple of miles and emerged on the crest of a ridge which gave us a view of country to the south which I had not yet seen; and I was much interested in being able to recognise Muleyit Mountain standing high above the surrounding hills. It appeared decidedly steep on the north and east, but easy of access on the west. We came to the end of the ridge and rested, while we overlooked the valley of the Upper Thaungyin. It was fairly easy to trace the course of its numerous affluents; the Megla, Ungrin and Gorli being the bigger streams ; all of these meet a little above Miba, and there begins the Thaungyin proper. Beyond the Thaungyin basin rose the great hogsback previously referred to, and I decided that it would well repay a visit; but I have not yet been able to reach it, though in the course of my journey I eventually made the complete circuit of it. I hope to make it the main objective of a future expedition.

We started down the slope below us and found it desperately steep, so that careful zigzagging was necessary and progress slow. When we had descended the 1,600 feet to the valley below, we found a pleasant spring beneath the shade of a great banian tree, and had a drink and a rest there. As I lay on my back gazing idly up in to the tree, I became aware of movement high up in the branches, and made out some birds, which at first I took to be parrots. An examination with the glasses showed them to be Pin-tailed Green Pigeon, and what had deceived me was that they were climbing about just like green parrots ; and, though it is possible I was mistaken, I certainly thought that they were using their bills as well as their feet in moving from branch to branch. Stuart Baker doubts this habit, as observed by Harington, but from observation on this and later occasions I certainly think the latter to be right on this small point.

The elephants had taken a ridge with an easier grade further to the south, so we pushed on down the side valley for about two miles until we reached some fields and the main Ta'ok stream ; here about thirty yards broad and two feet deep. Finding we were to wade it, I took off my boots and putties, a precaution I soon ceased to adopt when I found that on most marches in these regions I had to wade a river every half mile or so.

Another mile down stream we came to Ta'ok village ; a miry, squalid agglomeration of a dozen bamboo huts ; beneath whose piles the pigs rooted and fowls and ducks squattered.

I have not yet remarked on the number of ducks which are to be seen in every Tenasserim village. They are much more numerous than the fowls, and one can nearly always buy ducks' eggs whereas fowls' eggs are scarce.

A few hundred yards beyond the village we came on some jungle-fowl, and I succeeded in slaying one for dinner, then we forded the river twice more, returning to the right bank opposite a cliff some 400 ft. high. Lower down the valley on the north side I could see an arc of much bigger limestone cliffs, not less than 800 ft. high, which rose so sheer that little vegetation clung to them. We reached the end of the cliff immediately above the river, and saw a one-roomed wooden hut on piles on the opposite bank, which was to be our resting place. To reach this first entailed fording a tributary on our own bank, and then the main stream, whose bottom was mostly boulders and large holes. The water was waist-deep and the current strong, so it was not surprising that I slipped in midstream and took a thorough ducking. In half an hour the elephants arrived and took the ford very seriously, testing each pace under water with their trunks. Nawash Ali, my big Punjabi bearer, tried to cross a little lower down by jumping from boulder to boulder ; he got half way, and then slipped and fell in with a noble "splosh", much to the delight of his nephew, Mahomed Kasim, who laughed so much that he slipped off the rock on which he was standing, and fell in also. The whole of my retinue were so delighted with this double mishap, that I could scarcely get them to unload the elephants ; they were like a lot of school girls with a bad fit of the giggles.

These two Punjabis had been with me, sometimes one, sometimes both, for fifteen years, and were a great standby in the jungle. They were natives of Punch, from which State so many good servants come.

There still remain two more of my staff, orderlies Kunjanaw and Sambat gaw. These were Kachins and spoke several dialects each but unfortunately not one of the local ones, and they were little use as interpreters.

Ta'ok forest hut marked the end of the first stage of journey. We were now in the Thaungyin Valley, and the next stage would be the crossing of the hills on the far side of the Thaungyin into the Meping Valley.

(*To be continued.*)

H. R. H. THE PRINCE OF WALES WITH HIS 'BEATERS' AT THE END OF THE TIGER SHOOT.

MAHSEER HOOKED BY H. R. H. AND ADMIRAL HALSEY.

H. R. H. THE PRINCE OF WALES' SHOOTING IN INDIA IN 1921 AND 1922.—PART III.

BY

BERNARD C. ELLISON, C.M.Z.S., F.R.G.S. (*Naturalist to the Shoots*).

(*With* 7 *plates and* 1 *map and* 4 *diagrams.*)

I. MYSORE.

To entertain distinguished guests visiting Mysore, elephant capture and roping form one of the principal items from a spectacular point of view, fishing is included also, so I have included the account of the Kheddah operations which took place during H.R.H.'s visit and also the Mahseer Fishing.

On previous Royal shooting trips in Mysore it was usual to spend a week at the camp at Karapur and, in addition to shooting both big and small game, to witness the operation of capturing elephants.

But as His Royal Highness' stay in Mysore could not be prolonged for more than three days, the programme at the shooting camp was at first confined to—

1. Tiger Shooting, 2. Bison Shooting, 3. Fishing.

The definite programme of His Royal Highness' visit was received in the middle of August. Immediately thereafter preparations were taken in hand to fit up the shooting camp to meet the convenience of H. R. H. and his party. During the short stay of the Prince in camp, it was at first thought inconvenient to fit in a keddah with big game shooting, but eventually it was considered that a part of one day (Sunday) might be conveniently spent in witnessing the drive of elephants and the subsequent roping operations. Thus, the full programme was arranged for, as on former occasions, in spite of the short stay.

For convenience I have subdivided this account under these various headings, rather than depict the various events in the sequence in which they actually occurred.

H. R. H. and staff arrived at Mysore on the 20th January. This narrative does not concern itself with the functions or stately ceremonial with which the Maharajah of Mysore entertained the Prince of Wales: though to me a stranger in the land they were of absorbing interest, but "That is another story."

The writer arrived a day previous to the Royal party and a preliminary visit to the shooting camp and an inspection of the arrangements that had been made for the treatment and disposal of the expected trophies showed that everything was ready.

TIGER SHOOTING:—On the morning of the 21st January I left for the shooting camp in advance of the rest of the party. The weather was rather dull at first but cleared up later. The road to the camp was in good condition and shaded along the whole route by large banyan and tamarind trees, a good many of which were numbered, to facilitate replacements. A curious feature of the numbers on the milestones proper was that at first they were painted black on a white background, but as we progressed further and entered the jungle the numbers were painted white on a black background. The reason for this is that the former seem to displease wild elephants, who invariably uproot the ones with the black figures on a white background, while *vice versa* they ignore the ones with the white figure on a black background.*

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* In a miscellaneous note in another part of the Journal I have commented on this curious antipathy of elephants to milestones.

The roads in the vicinity of villages and hamlets were lined with expectant crowds waiting to get a glimpse of H. R. H. and generally every village had at least one arch made of leaves of various trees and other greenery.

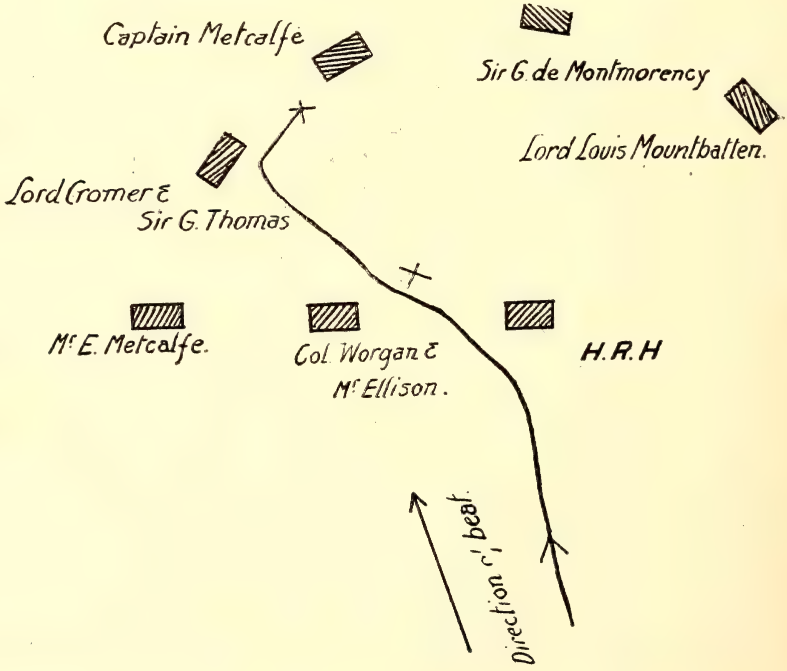
The country at first was undulating and without trees, but after we had passed Hampspur hills began to appear and the country became more wooded.

Of bird life there was very little to be seen, with the exception of the ubiquitous mynas, doves, etc., with a few cattle egrets in the fields and an occasional dabchick in the small tanks.

The first shoot was to be a beat for tiger in the scrub jungles of Heggadavan Kote where H. H. The Maharaja had killed two tigers the previous year. The *modus operandi* on this occasion was as follows :—

" The jungle had been baited with buffalo calves a few days prior to the Prince's visit, and on a kill being obtained the area was enclosed by nets in the shape of a semi-circle, and on the tiger driven into this, the circle was completed, and the tiger kept in the enclosed space till the day of the shoot."

To reach the shooting ground we turned off the main road near the thirtieth milestone, and kept on till we reached a large nullah, where we left the tongas into which we had exchanged after leaving the main road. Here all got out and walked a mile further till we reached the site of the proposed beat where a lot of excited villagers awaited us. After lunch we clambered into our respective machans, the positions of which can be seen at a glance on the accompanying plan.



As soon as everybody was seated a shikari gave the signal and the beat started. For a long time their shouts came to us from a distance and did not appear to come appreciably nearer. It was apparent that they found the tiger reluctant to move, as he was, full of meat, and not inclined to go in the direction intended, *i.e.*, towards H. R. H.'s machan. After more than an hour of continuous beating, just when everybody was getting very tired, we heard the tiger roar. About half an hour later the beaters sounded quite near and their shrill discordant yells, so different from the more robust and manly shouts of the Nepalese, made a fearful babel of sound. Suddenly, on a small hillock in front, there was a snapping and rustling of undergrowth, and out rushed a fine tiger. A shot rang out (from the Prince's rifle we subsequently learned) and the tiger rushed along untouched down a small nullah right past our machan, and Colonel Worgan fired two shots in rapid succession hitting him with his second. The tiger then swerved off towards Lord Cromer, where he fell in some bushes, but, picking himself up in a moment, dashed on for another twenty yards. Lord Cromer and Sir Godfrey Thomas both fired at him as he passed, and he fell over dead. Colonel Worgan's second bullet had caught him high up, and would have proved fatal even if Lord Cromer and Sir Godfrey Thomas had failed to stop him at once. He measured 9 ft. 3 inches between up rights, of which the tail accounted for 3 ft. 3 inches, while his height at the shoulder was 3 ft. 1½ inches. Along the curves he measured 9 ft. 8 inches over all.

On the afternoon of the 23rd January, a party motored out about fifteen miles to a spot, where a tiger had been netted.

The machans were situated along a path and we soon occupied them. Major Harvey was in No. 1, in No. 2 Mr. Aubrey Metcalfe, and Colonel O'Kinealy and myself occupied another one.

At 4-45, suddenly there was a crashing through some bushes close at hand and an occasional "ugh" was heard but the tiger appeared to be keeping a parallel course to the guns and did not break cover.

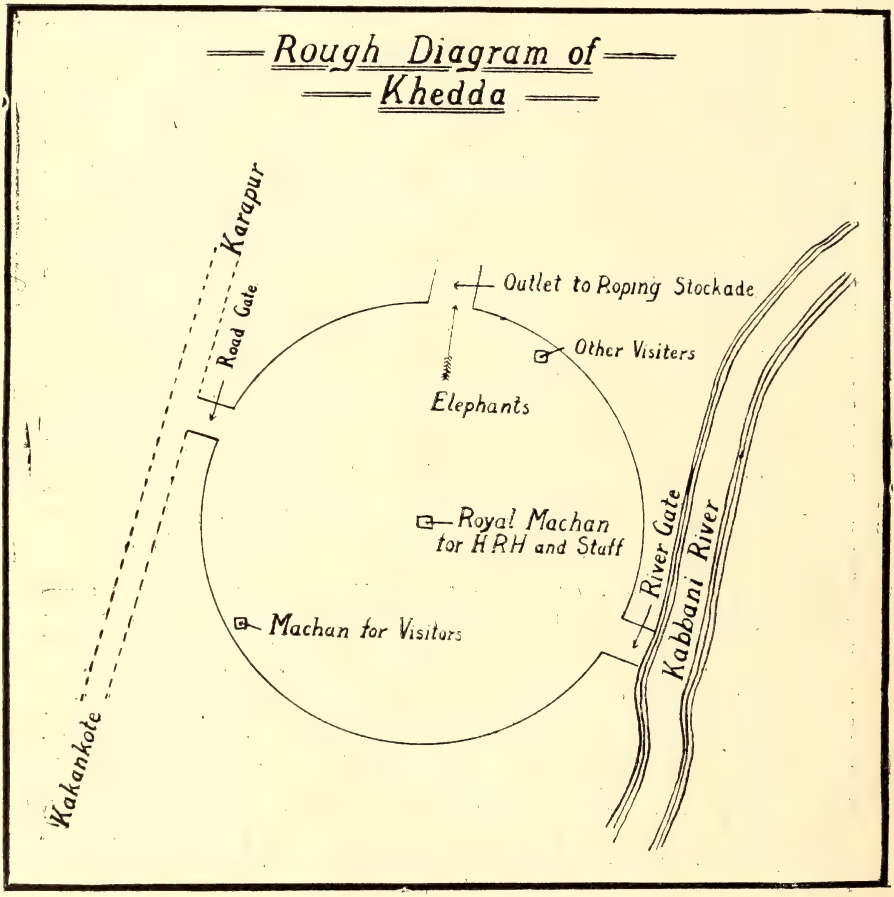
There were several reasons I think, why the tiger would not come out. The path where the machans were situated was rather too broad and without cover, and being a sagacious tiger he did not quite like the look of such an opening. Moreover there was a certain amount of talking in some of the machans. Colonel Worgan told me he saw the tiger distinctly on one occasion while he was hesitating to break cover. The shikaries declared that if we had been able to remain another half hour, they would have got him out. Every one was rather annoyed at having to leave, but as it was getting late and the staff had to be back in Mysore, a matter of thirty miles distance, for the farewell dinner, it could not be helped; so we all descended from our machans and had some refreshments where the cars were waiting.

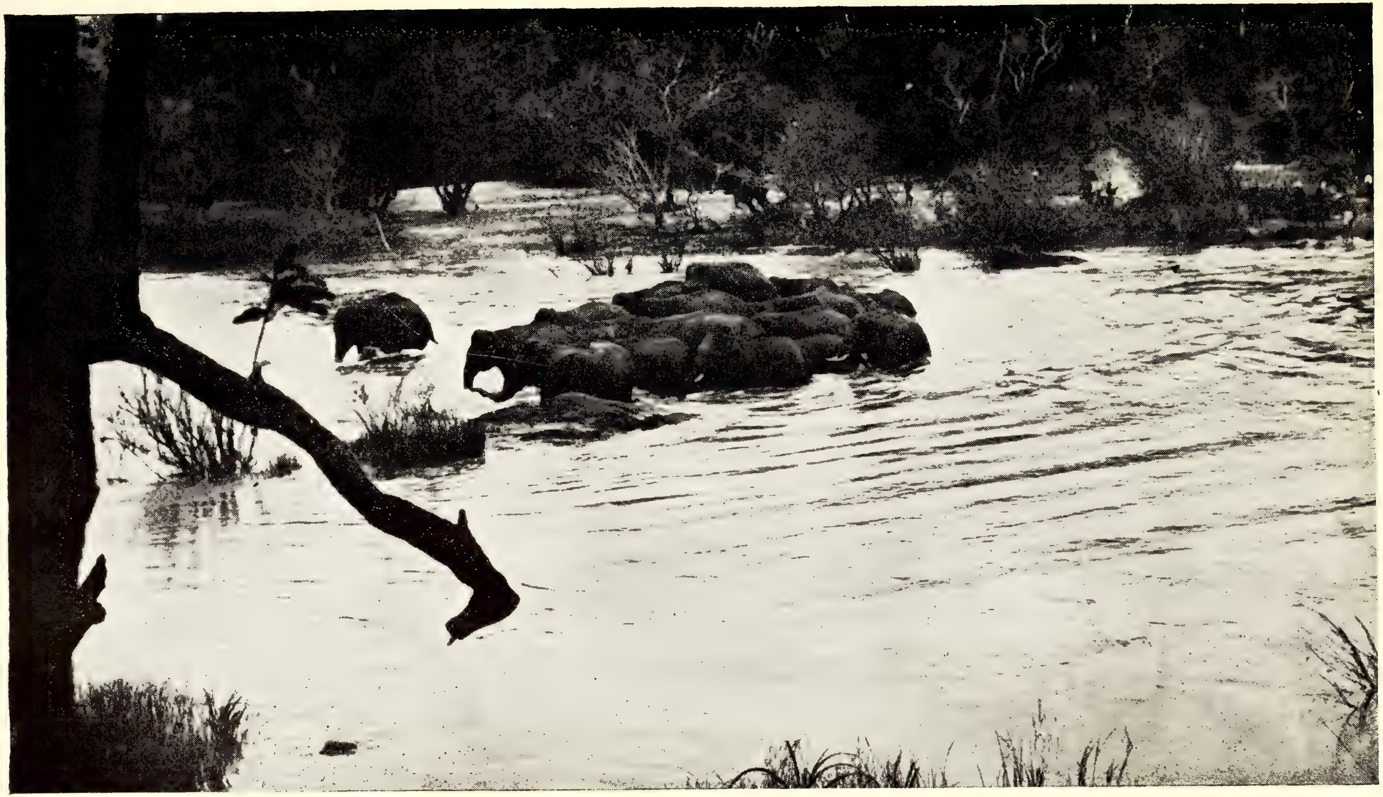
I remained behind and watched the forest officials wiring up the place where the tiger was, as they intended to try to get the Maharajah to come and shoot it on the following day; (incidently Captain Beddington killed it the next day.)

KEDDAH OPERATIONS: *The Camp for the Keddah Operations.*—The camp at Karapur, which is about five miles west of the scene of the Keddah operations, is of a more or less permanent character, there being several bungalows maintained for the use of Royal and Viceregal guests. It stands in a break in the jungles on the crest of a small hill. The tents for the staff are pitched on undulating terraces and command a fine view of the river and the surrounding country. Altogether it is a delightful camp offering such rare opportunities for shooting and fishing as is seldom met with in juxta-position in any other part of India.

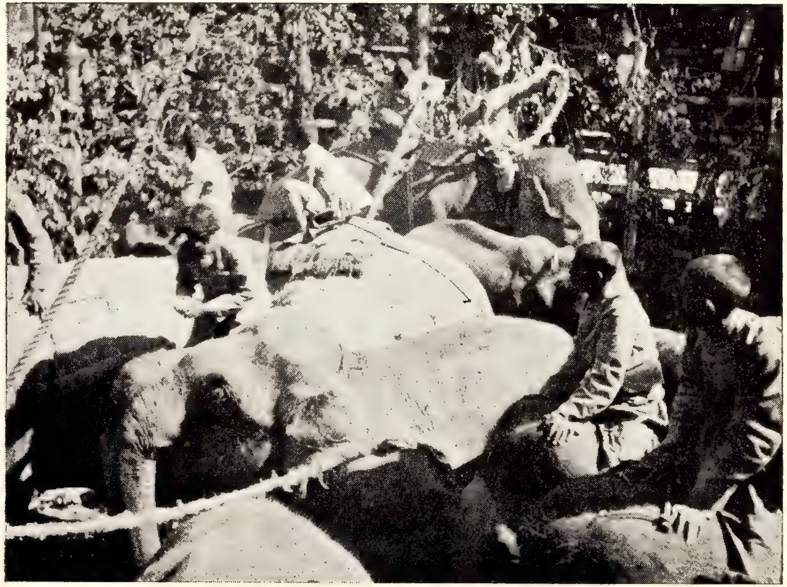
To reach the scene of the operations, I left camp about 10-30 a.m. with Dr. Rushbrook Williams. We motored the intervening seven miles through dense forest consisting for the most part of bamboos. En route we passed some teak plantations (*Tectona grandis*), here the Indian Walnut (*Terminalia tomentosa*) seemed particularly abundant. On arrival at the Keddah we proceeded on pad elephants to a large machan built in two tiers, and from this watched the beat. This was one of three built in a huge enclosure, about a mile in circumference, erected in the middle of the jungle. I am indebted to Mr. B. V. Rama Iyengar, Conservator of Forests, Mysore, for the following :—

History of the present Keddah.—" Six weeks or more before the Prince arrived in Mysore, an area of twenty to thirty square miles of jungles were driven by over a thousand men. As a result of this drive about twenty-eight elephants, including a large tusker, were driven into an enclosure, around which was a huge trench a mile in circumference, which was guarded day and night so that none of the herd could escape. Morning and evening, paddy, grass and other fodder were placed near the gate and the wild elephants used to come and feed. Inside this enclosure was another smaller one called the " roping in " enclosure and it was to witness the herd being driven into this, and roped, that the Royal party had been invited. To have seen the whole of the operations from the beginning would have entailed a stay of several weeks, which was naturally impossible.

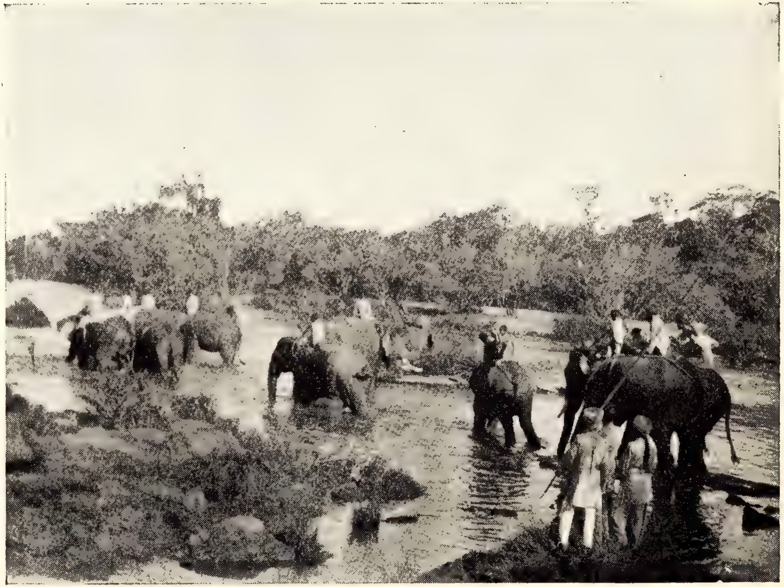

Rough Diagram of Khedda
Karapur
Road Gate
Outlet to Roping Stockade
Other Visiters
Elephants
Royal Machan for H R H and Staff
River Gate
Kabbani River
Machan for Visitors
Kakankote



The herd of wild elephants being driven across the River Cubanny.



The 'tying up' operations in the Keddah.



Watering the captured elephants.

The idea originally was to arrange for a chance capture of elephants. But contrary to their usual movements, the migration of herds towards the evergreen zone, which ordinarily occurs about a month after the close of the North-East Monsoon, commenced earlier than usual. As herds were marching towards the Forests of Wynaad and the Coorg Frontiers, the situation became critical. At this juncture, information was received on the 8th December, that one small herd was near Sunkadakatte-Kymara Road, apparently on the move towards Coorg. A few men, about a hundred in number, were mustered immediately, and marched off to block the road. As the men were being posted, a part of the herd was seen to stray away to the wrong side. A small party, however, faced the main body at once, and drove it back. The next day, the whole herd was driven across the Burudekatte line and was surrounded on three sides. The third day, it was forced across the old Balle surround line, when the animals got into dense thickets of big bamboo, and it was very difficult to dislodge them from cover. It was only after a considerable amount of trouble, for two continuous days, that the elephants were driven into the river at about 5 p.m. on the 17th December, and from there into the Keddah.

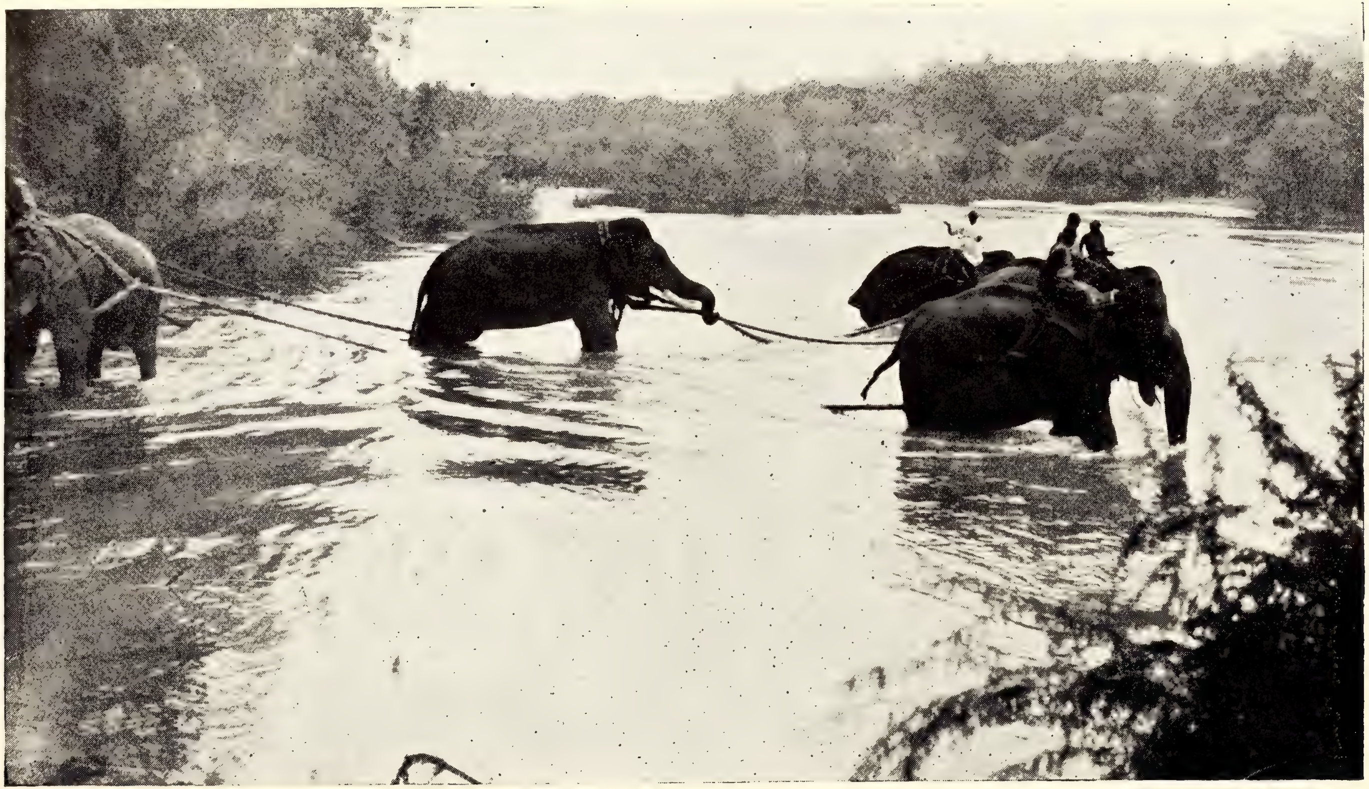
Measures were taken to guard the elephants from getting out of the enclosure by posting men all round the Keddah to keep fires alive at short intervals. The construction of the roping stockade and machans was pushed through and brought to completion soon after."

The Beat.—Immediately on taking our seats on the machan we hear the elephants trumpeting. The Forest Officer informs us that they have gone to a pool for water and are evidently enjoying themselves there. The signal for the drive to start is given by bugle, and at once the *koomkies,* (decoy elephants), each with a mahout on his back and also a spearman, or a man armed with a gun, move out of their concealment into the open. They try to drive the herd before them, aided by shouts, the noise of bamboo clappers, the firing of guns and shrill cacophonies from trumpets. After about a quarter of an hour there is much trumpeting and out rushes the herd, raising clouds of dust as they crash through the jungle. As they pass fairly close to the funnel-shaped mouth of the inner stockade, I catch a glimpse of them. They are mostly cows and one or two very small calves. Again and again they break through the encircling *koomkies* steadfastly refusing to enter the funnel shaped passage leading to the inner stockade, entrance into which means a life of useful toil in the service of man. The scorching midday sun pours down on our machan where we are practically unprotected. The beating operations continue for a considerable time and appear to the uninitiated one huge confusion without method or order. We keep silence the whole time. Suddenly the trumpets blare and then comes the sound of mighty crashing, and out come the elephants again through the jungle. I snap a photograph once, twenty-three of them together, passing our machan about twenty yards away. The sound of the bells on the tame elephants resounding everywhere coupled with the shouts of beaters and the crashing of breaking branches beaten down by the advance of the wild herd, make a wierd medley of sounds. A shot rings out, the trumpets blare again, and the elephants rush on wildly frightened. No one knows exactly what is happening; there is nothing but clouds of dust, crashing of the undergrowth and the breaking of trees, shrill trumpetings from a scared tusker, mingled with wild and weird shouts and yells. On several occasions they get the whole herd up to the mouth of the enclosure and let them break away again, owing to the fact that there are no stops on one side. Each time the elephants come rushing back they are met at full charge quite near our machan by shikaries, guns, roars and shouts, and so turn tail rushing in wild confusion in the direction of the "funnel." The little calves seem to be the most frightened of all, and one cannot help pitying these poor little animals. The herd first rushes to one side and then to the other, and when they go in the wrong direction if the trumpets and the shouts do not suffice to turn them, they are fired at with shot guns. They generally seem to break away at one particular point on one side of our machan, where first two get through, followed by another six, and then the remainder of the herd. Time passes, and the herd is gradually pushed nearer and nearer the funnel, and is practically in when there is a sudden movement on one flank, and quite a number break through at the same spot. It is fearfully hot, the backs of the elephants gleam with water from the ditch they went through. The whole proceedings are very long, and as the herd seems to keep to one side, fires are lit all round by simply putting a match to the jungle—a most dangerous proceeding, as one cannot help but feel that there is considerable danger of everything being burnt down in such dry jungle. Suddenly there is tremendous excitement, and if possible the pandemonium increases in volume. The beaters are trying to close in on a particular tusker who is surrounded by pad elephants, and as the fire is blazing on one side it looks as if there is no chance of escape.

The whole place near the "funnel" is enveloped in smoke which the tame elephants do not seem to mind in the slightest. Finally, bewildered by the noise, harassed by small shot, and goaded on by thrusts from the spears, the herd rushes for the place which seems to be the only comfortable spot for them in the jungle. Too late they realise that their companions are tame elephants, with business like men on their backs. Crash, and down comes the gate, and freedom is a thing of the past. Yet even at the last moment, when three cows and a young bull have been entrapped in the funnel, the rest of the herd escape at the same weak spot on the opposite side of the machan. I got a snap of the big tusker as he passed. At this point we all left the machans and proceeded to camp and later returned to the inner stockade to watch the tying up operations.

The Tying up Operations.—Within the small circular stockade took place a scene, half comic, half pathetic. The captured elephants struggle against the *koomkies*, and show temper. Tears of vexation come to their eyes. They sulk like human beings. They trumpet angrily and throw themselves on the ground but are met with stolid calmness—are hustled kindly but firmly; and finally, sad but subdued they are roped and noosed. There were only four elephants inside, but it took hours to rope them, and one of the cows gave a lot of trouble, trying to push the stockade down and rolling about and groaning in her fury. As the men on the tame elephants tried to slip the ropes around their heads, the wild elephants showed their sagacity, ramming their heads tightly against the sides of their companions and refusing to lift their heads up. We then left the Keddah, and my last recollection was of a seething mass of men and elephants, with one poor little tusker down on the ground, thoroughly exhausted and done up. After we left, the heavy gates of the inner stockade were pulled up and the captured elephants were taken down to the river, where they could be seen being watered about twenty minutes later. Thus ended a most wonderful, but in my opinion, rather cruel experience.

Second Day's Keddah Operations.—On the next day (23rd January) the operations were resumed. The Prince of Wales was not present, as he decided to have a morning's sport with 'Mahseer', but several of the staff watched the proceedings from the Royal Box, a huge machan, seventy or eighty feet high, which had been specially constructed to give H. R. H. an uninterrupted view of the Keddah. The upper tier of the machan was capable of seating thirty or forty persons and was provided with comfortable chairs and cushioned ottomans. The actual operations did not start till about 10 a.m. as the large fires lit on the previous day had first to be extinguished. They were carried out on the same lines and one caught occasional glimpses of stray individuals of the herd crashing through the dense cover. I noticed an old tusker, who had advanced to a quiet place near the machan, stop and rest for a few minutes. As he stood swaying his great trunk and throwing dust over himself, the great grey monste



Captured elephants crossing the River with Koomkies.

seemed glad of a few moments' peace. What often seemed like certain success was repeatedly doomed to failure. As the elephants seemed to be safely entrapped they suddenly broke out, led by a cow, which had escaped in a previous Keddah operation, and seemed to know the ropes thoroughly. The reason of this constant breaking back was possibly the white dome of the stockade which rather seemed to frighten them. There appeared to be three reasons which kept the elephants from going into the Keddah :—

(*a*)—They had been kept too long in the stockade (over five weeks).

(*b*)—There were " tame escapes" which knew the danger points and kept the rest of the herd away.

(*c*)—The presence of the " Tusker " who drove all the others away. This individual on the following day killed one of the tame elephants by running its tusk into the unfortunate animal's eye.

The operations were continued on the following days with varying success. Early on the morning of the 24th, one cow and four calves were captured. The beasts looked very miserable. One had been badly prodded in the eye and bled profusely, whilst another seemed to be a mass of punctures. The cow had given a lot of trouble and some people had nearly been killed. The big " Tusker " was however still at large and evaded all efforts to ensnare him.

In giving this account of the Keddah operations, I ought to say that I know nothing of the lines and business on which they are usually conducted. (For these reasons I have got together some information from experts, and give this in another article. The present Keddah, it must be remembered, was exceptional, as obviously there were other factors to be considered beyond what would under ordinary circumstances be the main purpose in view, *i.e.*, the prompt capture and disposal of the herd. I have merely put down what I saw from the standpoint of the ordinary spectator.

Gaur Shooting:—Of the varied game the jungles of Mysore afford, the pursuit of the Gaur or Indian Bison as he is erroneously, though more commonly, termed holds no small place in Indian shooting. On the present occasion H. R. H. did not take part in the projected shoot, but a party consisting of Sir Godfrey Thomas and the Earl of Cromer had an unsuccessful, though not uninteresting day, in pursuit of some of these animals. Sir Godfrey Thomas has very kindly supplied me with an account of the days adventure ; he writes—

"Cromer and I got up at five and motored off in the dark with a driver who had no idea where he was to take us ; we had heard the night before that we were to go out after bison down the Keddah road, so we drove along hoping for the best and trusting that we should come upon the howdah elephants somewhere. After going about seven miles we pulled up at a house,where there were some signs of light, and luckily found it to be where the special forest officer lived who was expecting us. We drove a little way along the main road and then turned up to the left, reaching the spot where the elephants were waiting, in about twenty-five minutes. They said it was no good starting off into the jungle before the sun was up so Cromer and I walked up and down the road to stretch our legs and also to restore our circulation, as it was very cold in the cart driving out. Soon after sun-rise we climbed upon the elephants, sitting on either side of the howdah, with the shikari in a kind of dickey sitting behind. We struck straight into the jungle which was pretty thick (though there was no bamboo, as in Burma) and two trackers went on ahead, while a number of wild looking villagers followed behind. There had been a herd of bison there the day before, and we kept on their tracks the whole way. After getting down to a densely covered water course we lost the track and wandered about rather aimlessly but soon met some other wild men who told us that the herd had split off into two that morning and gave us the right line to take. About here we could have got quite a good shot at a sambhar, but it was not much of a head, and as we did not want to spoil our chances of a bison we refrained from shooting. We then crossed the nullah, and, after we had gone about a quarter of a mile up the other side, came on top of part of the herd. Then the trackers whistled and I looked all round the middle and far distance, never expecting to see them so close. A great big cow was staring at us from some bushes quite near, and behind we could distinguish the forms of her companions. They appeared to pay no attention whatever to the elephant, and we slowly circled the whole herd, only to find to our beaters' disappointment that there were about eleven calves and no bull at all. Personally, had I been alone, I should very probably have fired at that first cow, so enormous did her head look, and many people in those jungles have apparently made this mistake. It was bad luck and after following the herd for some time they suddenly took fright and galloped off in a long line. Later we went on to try and find the other lot that had split off from the main body, but only saw two calves and met a small sambhar not really worth shooting. On our way one of the trackers said he knew where a bear lived so we took the elephant in the direction indicated, while all the men on foot proceeded to climb up trees (they will face most things rather than a bear).

What we found was a big circular pit, at the bottom of which were nestling three of the most delightful black cubs, about a month old. They were too young to take away, as they would not have lived without their mother. She must have been somewhere around foraging, and none of the men were anxious to remain in the vicinity in case she came up in a hurry and found us there. So rather reluctantly we left them, and made our way back towards the road. It was by then about noon, and no good going on, as all the animals in the jungle would be lying up."

January 24th.—Captain Beddington of the Queen's Bays and H. H. the Yuvaraja went after the same herd of Bison the next morning and had better fortune. I quote from Capt. Beddington's account of his experience :—

> " Half a dozen trackers having located two bulls the previous night, we left by car about 6 a.m., picking up a forest officer on our way. We went about a mile and a half up a road in the Kakankote forest, and met a howdah elephant which we mounted.
>
> We had some difficulty in following up the tracks, and a Sambhar kill was passed on the way. At about 10 a.m. we were beginning to give up hope, when some fresh spoor was seen and almost immediately afterwards two bulls came into sight. One appeared to be a magnificent animal, but the other was a small one. The Rajkumar fired his ·475 at the big one, but it was a difficult shot, as the jungle was thick, and they were moving away from us. We saw them for a second or two crossing a deep and wide nullah about two hundred yards off, and both of us fired, but we could not tell the result. We crossed the nullah, and got into some very thick jungle with dense undergrowth, but were unable to follow the trail of blood. Suddenly there was a tremendous rustle in the long grass and we both leant over and fired at the invisible bull, and at the same moment our elephant turned round and fled through the thick jungle giving us an exciting time, but fortunately the mahout soon got the animal into control.
>
> After a little light refreshment I went on foot to dispose of the wounded bull. This being my first venture in the jungle I was not especially keen on doing so, not having sufficient confidence ; however I went in and fired my first shot from a tree, but eventually got quite close up and as he came towards me dropped him with my Jeffrey, ·400 magazine rifle. He was a big bull but his head was not exceptional :—Span 72″, spread 38″, girth 13″."

MAHSEER FISHING.—On the 23rd January 1922 the Prince of Wales went Mahseer fishing in the River Cubanny, quite near the Elephant Keddahs which are on its banks. He was accompanied by Admiral Halsey, Lord Louis Mountbatten and Mr. Bowring, Deputy Commissioner of Mysore. Mr. Van Ingen had gone on in advance.

This river, which has its source in British territory, runs through beautiful forest up to Karapur, the Maharajah of Mysore's shooting Camp, after which there are no more jungle lands.

From Bavali, which is the frontier, there is probably about fifteen or twenty miles of water up to Karapur, the end of the Kakankote State Forests.

All these waters are strictly preserved—by strictly preserved I mean that nobody is allowed to fish without the special permission of the Durbar, with the result that Kakankote is seldom fished.

The Moplahs, Wadders, and other tribes who have their homes on the banks, set fish traps, night lines, and nets, whenever they please, but I do not think they do much harm, as there are places they fear to exploit for fear of wild elephants.

H. R. H. fished for three hours at a most picturesque spot, Kalikatte-Madu, near Kakankote, about two miles upstream from the Keddahs. The Prince and Mr. Bowring were the first to cross the river in a coracle paddled by Siddaiah, one of the most expert boatmen from Ganjam near Seringapatam. What happened can best be told in the words of Mr. Bowring.

"Before the coracle could return to bring the Admiral across, the Prince was in to a fish, but it was only a very small one of 3½ lbs.

Shortly after, the Prince got into a real big fish, which dashed first upstream and then down, the reel singing merrily all the time. After playing this fish for ten minutes, something went wrong and we found that the fish had got the line round a rock, or a sodden trunk of a tree at the bottom of the river. We did what we could, but it was no good, and the line eventually carried away.

Shortly after this, Admiral Halsey hooked a big fish at a spot a little lower than where the Prince had been fishing. This was a 'whopper' too, but unfortunately the fish again managed to get round the same snag as the Prince's fish had done. H. R. H., Sidiah and myself went out in the coracle to try and release the Admiral's line. We succeeded in the end, but by that time the fish had got off. In the meanwhile Lord Louis Mountbatten, who was on the other side of the river had three runs, but a lot of bamboo had some few years ago fallen into the river at this spot where it flowered and died and he got hung up each time and was unsuccessful.

H. R. H. went on fishing after clearing the Admiral's line, and was soon into another fish. This one put up a good fight, and the Prince played him like an old hand at the game, and I was eventually able to gaff the fish for him. He turned the scales at 18 lbs.

The Prince caught two more fish but they were not big ones. The pool had been fished a couple of days before by some of the staff, and Captain Piers Legh had taken a 60 pounder out of it, and Captain Dudley North three small fish, 7, 7 & 4 lbs. and other fish were missed too.

The Prince's four fish weighed 18, 7, 6 and 3½ lbs. He was using a Hardy rod and *atta* for bait. Captain Dudley North caught a good fish of 43 lbs. at Manchagowdanahalli which he told me put up a magnificent fight. The Admiral also had some luck fishing near the camp and caught a 69 and a 28 pounder, Piers Legh also getting a 20 pounder in the same pool."

In 1919 when Lord Chelmsford fished this pool, which is known as "Kalikuttay Muddah," he got nearly 300 lbs. of fish, his best being a 77 pounder. During His Excellency's stay at Kakankote he got 27 fish in all, weighing 527 lbs.

Speaking of the late Viceroy Mr. Van Ingen wrote to me "Lord Chelmsford is a very keen angler, and if all the fish he hooked were landed, he would probably have had a thousand pounds."

It was a day of disappointment as the place was full of fish, and it was bad luck that H. R. H. did not land some big ones."

The writer had the pleasure of subsequently joining in the sport, and spent a most enjoyable morning in spite of being rather a novice. Mr. Bowring rather feared that we should have had bad luck that day as on our way to the fishing ground we were so unfortunate as to meet a Brahmin widow. Anybody who has been long enough in India will understand that this is very bad ! I caught nothing that day. There were no sensational catches but the day's sport yielded 8 Mahseer, 2 Labios, and a non-descript individual whom I cannot name. We resumed fishing the next day. No Brahman widow was passed, and in the first fifteen minutes I landed my first Mahseer. How my heart beat as I reeled him in, I felt that he would really be something over a hundred pounds ! 18 pounds the scale afterwards registered, but in the first flush of victory it felt as good as a hundred pounds.

NOTES ON SHOOTING, FISHING, ETC., IN MYSORE.

TIGER NETTING IN MYSORE.

Mr. B. V. Rama Iyengar, Conservator of Forests in Mysore, writing to me on the above subject says :—

"There are two principal methods usually adopted for bagging tiger in this part of the country. The first consists in locating the tigers by tying up a bait in the most likely locality. The tiger takes the bait and lies up near the kill for about forty-eight hours, unless disturbed. Within a couple of hundred yards of the kill, a line of machans are put up for seating the guns. A few hundred men get behind the kill, and walk through the forest making a fair amount of noise, and drive the tiger towards the guns. He generally breaks out, and rushes towards the machans.

The second method consists of locating the tiger as in the first. A net made of hemp ropes, with a diamond mesh about 4″ in width, and about 10 ft. in height is spread out about 150 yards away, enclosing a semi-circle in front of the place where the tiger is likely to be. The diameter of the semi-circle is generally a cleared line, about 6 to 10 ft. wide, which in length is about 200 yards. A couple of hundred men are collected and a few of them are posted along the other half of the circle, in places where the tiger is likely to break through. These are called stops. A few are put on trees along the diameter line. The others get behind, and drive the tiger. As soon as it crosses the line the beaters from behind are made to get on to it. Other nets are brought out and the two ends of the semi-circle are now connected by a line of nets along the diameter line. Subsequently, the semi-circle is reduced by cutting off edges, and the tiger is confined to a small area of about 100 yards diameter, enclosed by nets all around. After this is done, a number of machans are constructed in a convenient manner about fifty yards away. Just before the arrival of the shooting party, the line of nets nearest to the machans are removed. A party of beaters get behind and drive the tiger towards the guns."

It is this latter method that was adopted during H. R. H. The Prince of Wales' visit to the shooting camp, and the grounds selected for tiger shikar were close to Heggaddevankote, which are some of the finest tiger areas in Mysore."

BISON SHIKAR.

The same authority informs me :—

"Bison are found in the forests where wild elephants are also found, and the locality selected is the more open type of forest where the growth of grass is not very high. A short time before the day fixed for bison shooting a party of trackers locate a solitary bull bison or a good herd with a number of well grown bull bisons. They are just behind the tracked animal until the party arrives. Towards night fall of the day previous to the shikar, one of the trackers returns to Head Quarters and gives intimation of the place where the bison was located in the evening. Unless disturbed, the bison does not move very much during the night. Very early next morning the party get on to the elephants, which are stationed at a convenient place, and are taken to the bison ground and with a fair amount of luck ought to get a good trophy."

January is rather an awkward month for bison shikar as with a considerable quantity of dry leaves on the ground, going through the forest without noise is almost impossible."

MAHSEER FISHING.

The fishing consists of the red-finned variety of Mahseer, the Black Mahseer, *Labeo kontius, Labeo boya* (both the latter being locally known as "Kural"), Carnatic Carp, and lastly the fresh-water shark, "*Wallagu attu*". Besides these there are numbers of smaller fish which can be caught with worm or *atta* or a small live bait, and many again which are difficult to catch with rod and line, among the latter being Thomas' Labeo *L. calbasu.*

Mr. Van Ingen told me that he thought that an expert roach fisherman would make heavy catches of these fish.

He also writes :—

"Referring to the fish in the Cubbany, I do not think the Black Mahseer is a different species. It is exactly like the red-finned Mahseer in every respect except colour, a case of melanism.

At Birankuppe on the Cubbany there is a large spawning bed, known in Canarese as a "Thippay" within a few feet of a small island. Peering through the bulrushes which fringe the island I have seen the "Thippay" full of Mahseer, among which was a solitary black one, and my shikaries who had been there quite a fortnight before I arrived, and took a keen interest in this "Thippay", watching the fish for hours every day, assured me that the fish I saw was the only Black Mahseer which frequented it. I think this goes to show that the Black Mahseer cannot be a different species, or it would probably not associate with the ordinary Mahseer in this manner. The biggest Black Mahseer we have secured was a 22 pounder, caught by Mr. Bowring. I have however seen what were probably 50 pounders rising within a few yards of me at the Krishnaraja Sagara Dam. Of those I have seen caught, some had their sides and belly a beautiful shade of dark pink, others again were jet black.

I wonder how many of those who catch Mahseer know anything about their life-history ? Their spawning beds, or Thippays, as I have said they are called in Canarese, are most remarkable structures. Once you have seen a Thippay you could never forget it. It is invariably built in very heavy water, and is shaped like the letter U, both arms pointing up stream and composed of small round stones about the size of an egg, called in Canarese "*Jelly*". I have seen a Thippay where there was no *Jelly*, and the fish had worked a depression close to the bank, and thrown all the stuff up to a height of about five feet. They must of course have worked very hard to push all this amount of earth up to form a bank.

To build the ordinary Thippay, I believe the fish carry the stones in their mouths to make up the heap, and the big hen fish make the bed of the Thippay symmetrical, for every big hen fish I have seen during the rains has had the lower part of the tail and the anal fins rubbed down to mere stumps. To give an instance. I know of a very large Thippay quite 25 yards across, and regularly every year, in January, the villagers level this and make small beds for Carnatic Carp to spawn in, when they wait at night and net the entire shoal. Now how would this Thippay, which had been levelled, be erected again if the fish did not carry the *Jelly* back to the same spot ?

There are heaps of cock fish about every Thippay, the hen fish coming in only to do some spawning. The biggest cock fish I have caught was a 28 pounder. I do not think they go much above 35 pounds.

The "Kural", *L. kontius* and *L. boya*, are very handsome fish and great fighters. They are ground feeders, but love rushing waters and rocks ; it is useless fishing for them elsewhere. The Kural never sulks nor takes advantage of rocks and snags ; on being hooked, his one desire is to keep in heavy water.

The local fishermen say that the Kural feeds on Mahseer spawn. As soon as the Mahseer leave the Thippay, up comes a shoal of big Kural. Whether they hunt up the spawn ensconced in the *Jelly*, or whether they, like the Cuckoo, take advantage of a ready-made nest to deposit their own spawn, I cannot say. We have a great deal to learn about Indian fishing yet.

That only big streams hold big fish is true, for big fish want plenty of room, as they probably have to cover several miles every night in search of food. In pools, and in fact everywhere, Mahseer go in shoals. All the fat old hen fish of 70 to 80 pounds keep together, then the next size, and so on. Leaving out the babies, the 8 to 12 pounders form the biggest shoals.

Mahseer apparently spend all their lives in the same pool. They may go several miles up stream during the floods, but they drop back to their old homes as the water subsides. There must, of course, be new-comers to every pool, but I doubt if they are very numerous.

The male Mahseer is a beautiful fish, built on finer lines than his fat wife. He has little or no hog back, his fin and tail are very brightly coloured up to their base, and when gaffed and drawn ashore, the most wonderful opalescent shades of pink, blue and green, play over his silvery sides. I have more than once taken sketching materials with me; but have never used them as I felt it was simply impossible to produce such colours."

The remark about the female fish making the bed of the Thippay symmetrical and rubbing down the anal fin in doing so is borne out by the 72½ pounder caught by Mr. N. S. Symons with a rod and line in the Bowani river, now in our own Society's collection in the Prince of Wales Museum of Western India, Bombay.

THE FORESTRY OF MYSORE.

Some of the best Forests of Teak (*Tectona grandis*), Mr. Iyengar informed me, lie in this part of the country with an undergrowth consisting of bamboo in the well-drained localities, and tall elephant grass in the flat ground. The rainfall varies from 60 to 80 inches, and the predominating rock is diorite. The teak, which is the principal timber tree, attains enormous dimensions, and trees up to 19 ft. girth are not uncommon. The principal species associated with teak are:—

Dalbergia latifolia.
Terminalia tomentosa.
Adina cordifolia.
Grewia tilleafolia.
Garuga pinnata.
Pterocarpus marsupium.
Anogeissus latifolia.
Lagerstroemia microcarpa.
Eugenia jambolana.
Albizzias, and other deciduous species.

II. GWALIOR.

To the big game shot all over the world the State of Gwalior ruled over by the Maharaja Scindia, is synonymous with the word tiger, as it is in this State that some of the world's finest tiger shooting can be enjoyed.

His Royal Highness the Prince of Wales arrived in Gwalior on the morning of February the 8th and remained there till the night of the 12th of February.

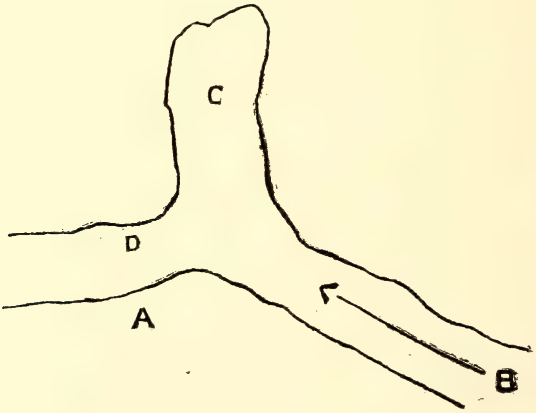
It was not necessary, as was the case in other States, to stay at a regular shooting box in the jungles; the parties who shot motored out to places in fairly close proximity to the city of Gwalior and returned each evening.

First Day's Shoot.

The first shoot took place on February 9th, and the following are notes from my diary.

About 8-30 a.m. I went round to the Palace. His Highness the Maharaja of Gwalior looked very happy sitting on the steps, waiting for his Royal guest to return from the Polo ground. On the walls all round hung magnificent skins, mounted and unmounted—chiefly tiger—all of which had been shot in Gwalior by the Maharaja himself. He looked a veritable King of Shikar surrounded by all these spoils of the chase.

Mr. Jardine, the Resident, told me that a record tiger had been seen lately and, as in Nepal, the Maharaja was very anxious that it should fall to the Prince's rifle. His Highness had evidently spared no pains over the arrangements and was looking forward to giving his guest the best tiger shooting available in the State. The start was fixed for 11 a.m., but it was well after 12 o'clock before we got off and clear of the city. The country round Gwalior is very dry in February, and the soil is of a peculiarly deep red colour: so we had to travel slowly to avoid the dust. The Prince was in the first car with the Maharaja who was driving. I was in a car with Colonel Worgan, Captain Piers Legh and Sir Geoffrey de Montmorency. The party included the Earl of Cromer, Mr. Jardine, Admiral Halsey, Colonel Worgan, Mr. Petrie, Sir Godfrey Thomas, Captain Dudley North, Captain the Hon'ble Bruce Ogilvy, Colonel O'Kinealy, Colonel Harvey, Commander Newport, Lord Louis Mountbatten, Captain Metcalfe, Mr. H. A. F. Metcalfe, General Knight, Colonel K. N. Haksar, Colonel Wagle, General Rajwade, Mr. J. W. D. Johnstone, Sir Harry Watson, Captain Sultan Hasan Khan, Colonel Bhau Sahib Shinde, Colonel Kok Singh, Colonel Girdhari Singh, and Captain Knight. After ten or twelve miles of dry and



H. R. H. RIDING TO THE SHOOT.

H. R. H. WITH HIS 3 TIGERS.
(Sitting:—H. H. The Maharaja of Gwalior.)

rocky country, we left the cars; The Prince, the Maharaja and Lord Louis Mountbatten mounted horses, and the rest of us got on elephants with shikar howdahs, and after going a mile as quietly as the hard ground permitted, we dismounted, loaded our rifles and went silently to our appointed places. H. R. H. went off in one direction with the Maharaja Scindia, accompanied by the Earl of Cromer, Admiral Halsey, Colonel Worgan, Commander Newport and some of the principal officers, to the position selected for him. Sir G. de Montmorency, Captain Dudley North, Colonel O'Kinealy, Mr. Jardine and I went to a spot further up, walking delicately over a formation of stratified rock, till suddenly we came to the edge of a dry ravine or river-bed, that seemed some two hundred feet deep, two hundred yards wide and a mile or more long, and then moved forward and took our places on the cliff. We there discovered that the Prince's party had also taken up a position on the edge of this ravine,* two or three hundred yards further down.

Some people, I noticed, had two rifles, one of them a heavy reserve weapon in case of accidents as it was quite possible, though improbable, that if the tiger broke cover on our left, and was not hit, it might try and get out on our flank, and then there would be danger for every one. To guard against this five or six soldiers with long spears were posted with us.

The tiger had been marked down in a heavy jungle near the junction of three ravines where the cliffs were some fifty feet high.

The Prince was posted on a projecting rock just beyond the junction, at "A." Nothing happened for sometime. A beautiful owl hooted, flew across the ravine, and disappeared into a crevice opposite.

Sandgrouse flew over us at a great height in twos and threes. In the distance the beaters were steadily moving up the ravine, the elephants keeping pace with them, and the troops which we could see lining the cliffs were gradually closing in; the whole scene was admirably staged as only a Soldier-Shikari like the Maharaja Scindia could stage it. Then suddenly two shots rang out, and we knew that His Highness' hopes had not miscarried. It was already two o'clock. We moved very slowly along the edge of the cliff to try and get a better view of what the Prince was doing. The shikaris said that there were two or three tigers. Then there was a roar, and a minute after two or three more roars followed by three shots at intervals of a minute. Was this the same tiger or another? Then silence once more. It was two-thirty. The beat was getting closer: we could hear the men making little grunts and whistles, 'Ur', 'Ur', 'Ur'. Then silence again. The tiger had ensconced himself in the scrub where it was thickest. This was however nothing like so thick as the sea of grass that I shall never forget in the jungles of Nepal grass so dense that not even a rhino or an elephant could get through at any pace. In such a place a tiger would be invisible. Besides, as a friend remarked, "You can go on plugging and plugging at a rhino that is all but invisible and make no impression, unless you hit him in one or other of the two vital spots, whereas in a Gwalior jungle not only is a beast forced to show himself, but you can hit a tiger almost anywhere with effect," and that makes all the difference between shooting big game in Nepal and shooting in Gwalior.

On this occasion, though, the tiger refused to show himself, and people began to throw stones down into the ravine to try and wake him up. Several shots were fired in the beat and we all moved up and stood in a bunch at the corner near the place where the Prince was standing. H. R. H. was on a rock

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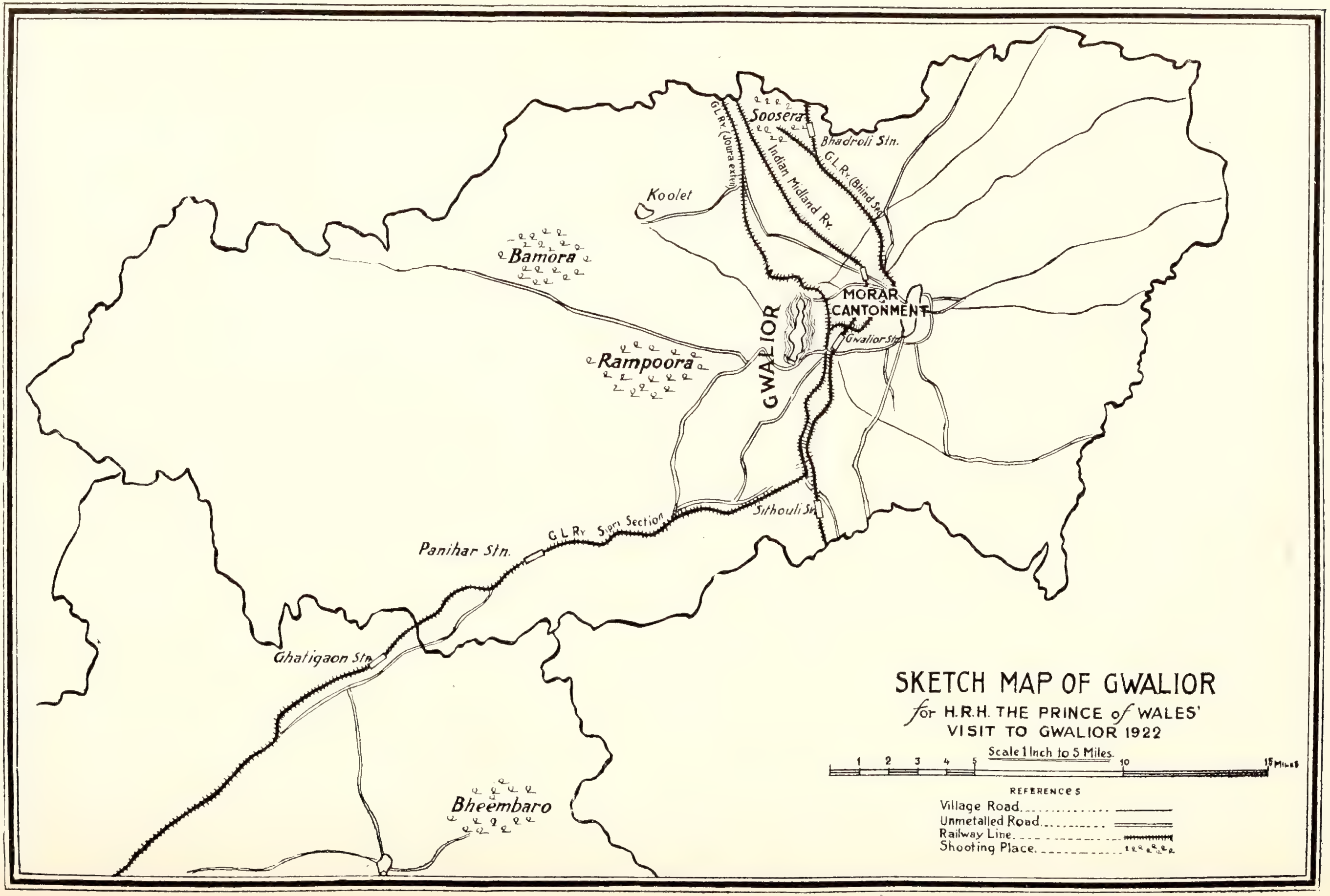
*It was here that M. Clemenceau got his three tigers in 1920. A herd of buffaloes had been put in the jungle that day to locate a tiger that refused to move on and face the guns, and a few of the buffaloes had straggled past when the beast emerged and attacked one of them, *en passant*, and in the rough and tumble M. Clemenceau shot the buffalo instead of the tiger, much to the owner's delight no doubt, for of course he was handsomely compensated.

jutting right out into the ravine, and near him were the Maharaja and Lord Cromer. His Royal Highness had his rifle ready for the moment the tiger should show itself again. The elephants pushed on to the place where the tiger was supposed to be lying. The beaters thought the tiger must have moved forward. Then without warning the tiger got up with a roar and made off down the ravine. We heard two shots and learnt that he had been headed off and was lying near the point B, from which the beat originally started. Some adventurous spirits mounted the shikar elephants and went down in search of the beast, but could not find it. Commander Newport spotted its ears and eyes: Bang-Bang-Bang, and the tiger was dead. We all went down the cliff and viewed her (for it is a tigress) as she lay in the nullah. I tried to get the beaters to move her in a good position for a photo, but they did not seem to understand, and moved her just into the place I did not want. Her glassy eyes seemed to look at me reproachfully as I snapped her two or three times.

Sir Harry Watson gave me a good account of what he saw from his point of view, which was much nearer the Prince.

"The beat commenced at B. (*vide* the preceding diagram). For some time there was no sign and we felt that the tigress must have made for C—but a line of elephants stopped her egress from the ravine, and beating towards the junction drove her into the open at D—just under the cliffs, about 150 yards from where H. R. H. was sitting. She was galloping at the time and His Royal Highness missed her; she disappeared into jungle, but shortly afterwards, frightened by stops, returned to the junction between D and C, and was wounded by the Prince on her way. At that point the jungle was dense, and the tigress lay very low, and though the elephants pushed in from C, not a sign of the beast could be seen or found. The elephants came almost up to the edge of the bushes and jungle below H. R. H. without finding a sign of her, so we concluded that she had slipped away down the nullah, past stops and beaters to B. His Royal Highness and those with him had left their places and were discussing the situation when the tiger uttered a roar from a bush in the ravine just below where the Prince had been sitting, and made for B. The Maharaja and the Resident, Mr. Jardine, ran along the tops of the cliffs as hard as they could towards B, and catching a glimpse of the beast fired at her, hit her very hard and stopped her. We all collected above B; some of us mounted elephants, went into the nullahs and eventually found and killed her in thick grass and bushes. It was a fine tigress measuring 8′-3″."

Lunch was then served among the rocks at the top of the ravine. The Prince was very pleased and so was the Maharaja. So indeed were we all, including the beaters. As we were sitting there we got a fine view of the beaters and the skinners, bringing the dead tigress through the jungle to the place where the pad elephants were waiting. I took a photograph of this incident, but it was a long distance away and my lenses were none too powerful, so the result was not very good. It appeared from what people said at luncheon there had been two tigers, one of which had got off unobserved. When she first got up, His Royal Highness had two shots one of which was fatal. She was right out in the ravine at the time when the Prince fired, so that it was quite a long shot. The Maharaja fired later and hit her in the back. It was very fortunate that His Highness and Mr. Jardine, the Resident at Gwalior, had the presence of mind, when the beast was wounded and getting away altogether, to run down and head her; and that at the moment the Maharaja Scindia fired and seemed to have missed, Mr. Jardine put in a shot that hit and stopped her, so that the Prince and the staff could come up and finish her off elephants. There were some nasty cut-outs from which the wounded beast might have emerged and escaped.



SKETCH MAP OF GWALIOR
for H.R.H. THE PRINCE of WALES' VISIT TO GWALIOR 1922

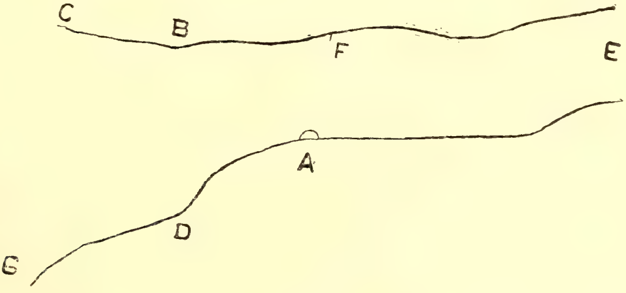
Scale 1 Inch to 5 Miles.
1 2 3 4 5 10 15 Miles
REFERENCES
Village Road
Unmetalled Road
Railway Line
Shooting Place
GWALIOR
MORAR CANTONMENT
Gwalior Stn.
Soosera
Bhadroli Stn.
G.L.Ry. (Bhind Sec.)
Indian Midland Ry.
G.L.Ry. (Joura extn.)
Koolet
Bamora
Rampoora
Sithouli Stn.
G.L.Ry. Sipri Section
Panihar Stn.
Ghatigaon Stn.
Bheembaro

On this day three black buck were also shot. The party who went after them were Mr. A. Metcalfe, Captain the Hon'ble Piers Legh, Sir Godfrey Thomas and Lord Louis Mountbatten. Mr. A. Metcalfe got two, Lord Louis Mountbatten one.

2nd Day's Shoot.

Friday, February 10*th.*—To-day the shoot was at Bhimwara, some 25 miles south-west of the city. The party consisted of H. R. H. the Prince of Wales, H. H. the Maharaja, Mr. Jardine, the Earl of Cromer, Admiral Halsey, Colonel Worgan, Sir Godfrey Thomas, Captain Dudley North, Captain the Hon'ble Bruce Ogilvy, Colonel O'Kineally, Colonel Harvey, Mr. A. Metcalfe, Lord Louis Mountbatten, Captain Metcalfe, General Sir Harry Watson, Mr. J. W. D. Johnstone, General Knight, Captain Knight and myself.

The whole country through which we motored was like yesterday—very dry and arid but not quite so flat, and most of the time we traversed rising ground with patches of jungle, scrub, and stunted undergrowth. We got away some time before lunch and—in spite of having to go slowly because of the tremendous dust,—in a comparatively short time reached the place where we were to leave the cars. They were on the side of the road near the luncheon tents and we all walked along a bridle path scattered on which were a tremendous lot of black and white droppings. There were quite a lot of porcupine quills too, strewn at intervals along the path, which were picked up by H. R. H. and by members of his staff. The Prince had them all collected. Mr. Jardine told me that in some parts of India the mother porcupines are credited with going into water, cocking their tail quills, which are not pointed but hollow, filling them with water, keeping them cocked and so taking liquid refreshment to their young at home. The shikaris who escorted us said that the tiger was in a hollow not far away, and that we must divide parties and proceed very slowly. As on the preceding day the Prince, the Maharaja, Mr. Jardine, the Earl of Cromer, Admiral Halsey and others separated and went off to the left; the rest of us halted for a few minutes, till the other party had disappeared down a slope in the ground surrounded by small jungle. Not much shooting, we were told, was expected on our side. We then went off in single file along stratified rocky scrubby ground, on which grew tufts of parched grass and small stunted trees, until we came to a place where we could see about a hundred yards in front of us a large dip in the ground, which we judged to be another ravine.



We passed to the left of this very quietly until we came to a stone wall at C on the diagram and there took it in turns to peer through a small hole like the aperture or opening in the turret of a castle. The view which met our eyes was a huge ravine, larger and broader than the one we saw yesterday, deep and wooded, its steep slopes covered with low jungle and rocks, with clearings (about twenty yards wide) about every three hundred yards cut right across it from top to bottom. It certainly was an ideal place for tiger, and more than one were supposed to be lying up in thick cover a thousand yards and more to our left, the colour of the jungle being peculiarly adapted to the powers of mimicry possessed by Felidae. On the other side of the ravine, half way down the slope and perhaps five or six hundred yards away from us, was one of the famous shooting towers, made of solid masonry, at the point marked "A" on the diagram, and to this the Prince had been taken quietly by the Maharaja, while the rest of the party were distributed further along the cliff at points covering the clearings, in case a tiger got past His Royal Highness. The tiger we were told had been seen within a hundred yards of the tower on the preceding night when part of a buffalo had been consumed. It was now about 2 p.m. and nothing had happened. Everything was quite still except when the silence was broken by the noise of a peahen flying down the valley. The beat started from E, just a few men throwing stones from the cliffs on both sides of the ravine. Commencing at the top it gradually worked its way down, and soon afterwards shots were fired from the tower across the valley. Naturally we saw little of what was going on, and had no idea what was being shot at, but it subsequently transpired that two tigers had come out at F and that one of them H. R. H. had killed dead with a single shot, a very fine performance right across that broad valley. About twenty minutes later shots rang out again and, with an 'UGH' and a roar, out rushed a big tiger at full speed down the nullah. We all saw him and he gave a very good show as he ran down the valley with shots and bangs going off right and left. He was first fired at from the other side, but appeared none the worse for it as he was still going strong when the shooting commenced from our side. It was of course next to impossible to know who hit him, but our side stopped him, and he disappeared in some rocky scrub low down the slope beneath us, and evidently lay up in the bushes, probably badly wounded, possibly dead. It was a magnificent sight, all the sportsmen standing high up on the ravine firing at the tiger as he rushed along a couple of hundred feet below. At a time like this a tiger looks ever so much bigger than he really is, and this particular one looked huge when breaking cover and bounding along the ravine, its yellow markings standing out very well against the bare open back-ground. It was an exciting moment as the whole incident was fully observed by the hundred odd people present. Although the tiger had been hit several times and everybody, who could, had had a shot, it had a good run for several hundred yards and disappeared in the scrub jungle not far away from where the Prince was posted. The problem then to be decided was whether we had to deal with one tiger or two—was it a dead tiger—or was it only wounded, and was it in the bushes, or had it moved and found shelter elsewhere? We then heard that another tiger, probably a wounded one, had been seen quite near us, in fact in the jungle just beneath. Buffaloes were put in at the far end of the ravine from which it was beaten, to locate the other tiger and if possible drive it past the guns again. The Prince and Maharaja Scindia were still in the tower. There was silence now for a time and the Maharaja's voice resounded from the tower right down the huge ravine as he shouted orders to the beaters. For it must be remembered that H. H. the Maharaja Scindia is everything in reference to shooting, conducts things personally and is satisfied with no half measures when matters pertaining to tigers are at issue. After a short time everyone got out of the tower and climbed up the side of the ravine. The Maharaja then shouted to the head shikari on our side and explained that one of the tigers was under a green tree to the left, right down the ravine in a nullah. As nothing happened and it was not safe to go into the gorge on foot, he decided to have the shikari elephants up and beat the ravine. It was 2-45 p.m. when they arrived and were put in at the bottom of the valley, where the sides were less steep. In the howdahs were Colonel Worgan and Lord Louis Mountbatten. A spot was noticed in front with a yellowish patch which it was thought might be the tiger lying dead. So deceptive was the coloration of 'Stripes' that even when glasses were brought to bear on the spot it could not be said for certain whether it was the tiger or not. Colonel Worgan and Lord Louis Mountbatten moved forward untill they came to a place where the elephants stopped dead. Just as on the first shoot in Nepal Colonel Worgan pointed out the exact spot where the tiger lay hidden, so to-day he shouted out "I think it is on the left" and advised movement in the direction of the small nullah. The elephants advanced slowly in this direction and suddenly stopped near some bushes. They smelt the tiger and would not go further on. Some one suggested that the best way to find out for certain the exact spot where the tiger wàs lying was to "lob a bullet into the place." Colonel Worgan tried a shot into the bushes, but the tiger did not come out. "He is dead all right" the Colonel shouted across to us on the cliff. The mahouts agreed in this decision and they seldom make mistakes on a point like this. The elephants would not go any nearer. They did not like approaching the bushes even though the mahouts tried their utmost to make them go in, they violently opposed all efforts to force them forwards and showed their annoyance ; they proved too that they were frightened by making cries like a little child. There, sure enough, was the tiger lying dead : the Prince's tiger, as he had got the first shot in. It being 3-35 the Maharaja Scindia decided to leave that tiger for the moment and beat down the ravine again and round up the other one, which was supposed to be lying wounded in the thick jungle just under our peephole. Now commenced an excruciating noise of Hara-Hah-r-r-r and shrieks and groans, so that one can but think that any wretched tiger that lies low when all this commotion is going on must be half-witted. The beaters appeared from all sides running about the ravine like a swarm of ants. When suddenly three bangs went off, one of which was made by a bullet and the other, from blank cartridges. Someone said the tiger was dying, others doubted it. In another minute the tiger's roar decided the question. There was another bang and it was difficult to say whether it was a shot, or whether it was only one of the bombs used by the beaters to drive sulky tigers. Finally some adventurous spirit went cautiously down the slope of the ravine and proclaimed that the tiger was dead. Altogether three tigers had been shot,—the one which the Prince shot at the beginning, the other which was located with the help of elephants, and then this one.

After lunch the three tigers were brought up and photos were taken of H. R. H., the Maharaja and party in front of the bag and surrounded by elephants.

In speaking to me later at the Kadir Cup Pig Sticking meeting at Gajraula the Prince told me how proud he was of them saying 'you remember the Gwalior Tigers, Ellison. Put a big mark on them.' He wanted special care taken of them and was very glad to have the lucky bones. His Highness certainly did shoot magnificently on this day. Sir Harry Watson who was with the Prince on the opposite side to me summarized his version of the day's sport as follows :—

> "Three tigers were soon seen moving in the bushes at the bottom of the ravine, two of them crossing to the side opposite to H. R. H. One of them, a tigress, stood for a short time at F, on the diagram, just showing her head and shoulders from behind a bush and H. R. H. made a very good shot, killing her stone dead at about one hundred and thirty yards across the ravine. The second tiger then galloped along the opposite side towards C, and did not give an opportunity of a decent shot though H. R. H hit him (slightly) as he crossed the clearing below B. He stopped in

the jungle in the side of the ravine between B and C. The third tiger then appeared going hard along the bottom of the ravine and was slightly wounded by H. R. H. Several shots were fired at him from B and C, and he eventually stopped in thick grass at G. Elephants having been called up, Colonel Worgan mounted one, and eventually found and killed this tiger. There still remained the wounded tiger in the jungle between and below B. & C. Beating from the top from B, and rather in the direction of the clearing below C, this tiger was found and killed easily by Major Sultan Hasan, the Superintendent of His Highness' Shikar Department."

After this H. R. H. and party went to look at the dead tigress at F and then climbing the opposite slope of the ravine proceeded back to the tents where the cars were awaiting them. The drive back in the evening was very pleasant and we disturbed lots of partridge and quail feeding near the bushes by the road side.

We reached Gwalior at 6 p.m. and were met by the Maharaja's little daughter Mary Kamla riding her pony astride. She had come out to meet the Prince of Wales and her father.

Sir Geoffrey de Montmorency, Captain Piers Legh, Mr. D. Petrie and Commander Newport, and ten others' guns went out after hare and sandgrouse.

They did a dozen miles or so in cars to a long low hill covered with scrub, and then rode two miles to the far end of it. There they found three hundred beaters and another three hundred men were distributed round the hill as stops.

The guns walked up the hill in line with the beaters who had to clear the way through the scrub which was quite thick. Hares were very numerous and gave good sport, while a few sandgrouse were put up.

Several things came out in the beat which were not at all expected, such as a panther and pig which fortunately did no one any damage.

The bag was 45 hare, 2 sandgrouse, 1 plover, 5 partridges and 1 quail.

3RD DAY'S SHOOT.

Saturday, February 12*th*.—This day The Prince did not go out as he wished to ride gallops for the Gymkhana Races in the afternoon.

The party proceeded by motor about twenty-five miles to the far side of a large Dam where they were met by elephants and horses.

Here they split up and drew lots for places, six guns going to the nearest place and the remainder to the farther one.

The programme was to beat a large ravine, some two miles long, a mile broad at the lower end and one hundred and fifty yards at the upper where it ran between cliffs some hundred feet high for at least half a mile.

The ravine was covered with very thick jungle which could only be seen through from the top, and at the upper end cuts were made for the principal guests to see to shoot. The guns were distributed along the tops of the cliffs.

A regiment of cavalry, dismounted with lances, acted as stops, while a battalion of infantry, armed with smooth bore muskets and black powder, supported by elephants and fireworks was the beat.

Communication was established by signal posts in suitable positions between the guns, the stops and the beat. The signal to advance being given, the infantry fired intermittently along the whole line of the beat for about five minutes to get the game moving in the right direction, and then commenced to advance, slowly firing as they came.

From the guns sitting concealed at convenient points on the rocky sides of the ravine this presented a wonderful spectacle. The white puffs of the muskets fired in the air shewing clearly above the greeny brown of the jungle the exact position of the beat even though the elephants were invisible.

Date.	Place where shot.
9th February ..	Rampura .. ..
10th February ..	Bhinwara .. ..
" " ..	" .. ..
" " ..	" .. ..
11th " ..	Bamora .. ..
" " ..	" .. ..
" " ..	" .. ..
" " ..	" .. ..
11th " ..	" .. ..
10th " ..	" .. ..
" " ..	" .. ..
" " ..	" .. ..

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* These measurements were taken by the

† This information was very kindly g

Date.	Place where shot.
21st Jan. ..	Heggedenankot
22nd Jan. ..	

Date.	Place where sho
24th Jan. ..	Kekenkata .

Date.	Whe
23rd January ..	Kalikatte Madu ne
" " ..	Do.
" " ..	Do.
" " ..	Do.
" " ..	Do.
" " ..	Do.
" " ..	Do.
" " ..	Do.
" " ..	Near the Camp
" " ..	Do.
" " ..	Do.
" " ..	Do.
" " ..	Do.

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*The late Mr. C. E. Murray Aynsley's got his 119 pounder, after which two Mr. E. Van Ingen and Mr. Bowring g while Mrs. Bowring established a lady's

GAME RECORD OF THE ROYAL SHOOT IN GWALIOR.

February 9th to February 11th, 1922.

Date.	Place where shot.	[*] Total length.	[†] Length dressed.		Sex.	Shot by	Remarks.
				TIGER.			
9th February ..	Rampura	8′ 3″	11′ 3″		♀	H. R. H. the Prince of Wales.	H. R. H. had two shots and got her with one. It was a very long shot at a distance of about 100 to 200 yards and a very good shot indeed. The Tigress was hit in the kidneys and was picked up jammed in between two rocks.
10th February ..	Bhinwara	8′-4″	9′- 2″		♀	H. R. H. the Prince of Wales.	
,, ,, ..	,, ...	9′-2″	10′- 9″		♂	H. R. H. the Prince of Wales.	
,, ,, ..	,, ...	8′-9″	9′-10″		♂	H. R. H. the Prince of Wales.	This was also hit by Mr. Johnstone.
11th ,, ..	Bamora	8′-8″			♂	Col. Harvey.	
,, ,, ..	,, ...	8′-0″			♂	Capt. Knight.	
,, ,, ..	,, ...	8′-9″	9′-10″		♂	Admiral Halsey.	I was also told he shot a Sambhar.
,, ,, ..	,, ...	7′-9″	8′- 6″		♀	Capt. The Hon'ble Bruce Ogilvie.	
				BEAR.			
11th ,, ..	,, ...	6′-8″			♂	Capt. Knight.	
				BLACK BUCK.			
10th ,, ..	,, ...					Mr. A. Metcalfe.	
,, ,, ..	,, ...					Do.	
,, ,, ..	,, ...					Lord Louis Mountbatten.	
				SMALL GAME.			
				On February, 10th, 45 Hares, 2 Sandgrouse, 1 Plover, 5 Partridges and 1 Quail.			

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[*] These measurements were taken by the Gwalior authorities under Col. Girdhari Singh. I took none of the Gwalior measurements.

[†] This information was very kindly given me by Messrs. Rowland Ward, who received the trophies in England

	Total.
Tiger	8
Bear	1
Sambhar	1
Black Buck	3

RECORD OF THE ROYAL SHOOTING AND FISHING IN MYSORE.

21st January to 23rd January 1922.

TIGER.

Date.	Place where shot.	Total length.	Height at shoulder.	Sex.	Shot by
21st Jan. ..	Heggedenankota	9′ 3″	3′ 1½″	♂	Colonel Worgan
22nd Jan. ..					Captain Beddington.

GAUR.

Date.	Place where shot.	Span.	Spread.	Girth.	Sex.	Shot by
24th Jan. ..	Kekenkata	72″	38″	13″	♂	Capt. Beddington.

MAHSEER.*

Date.	Where caught.	Weight.	Caught by
23rd January ..	Kalikatte Madu near Kallankote ..	3½ lbs.	H.R.H. The Prince of Wales.
,, ,, ..	Do. ..	18 ,,	Do.
,, ,, ..	Do. ..	7 ,,	Do.
,, ,, ..	Do. ..	6 ,,	Do.
,, ,, ..	Do. ..	43 ,,	Capt. Dudley North.
,, ,, ..	Do. ..	7 ,,	Do.
,, ,, ..	Do. ..	7 ,,	Do.
,, ,, ..	Do. ..	4 ,,	Do.
,, ,, ..	Near the Camp ..	69 ,,	Admiral Sir Lionel Halsey.
,, ,, ..	Do. ..	28 ,,	Do.
,, ,, ..	Do. ..	20 ,,	Captain the Hon. Piers Legh.
,, ,, ..	Do. ..	60 ,,	Do.
,, ,, ..	Do. ..	4 ,,	Do.

---

*The late Mr. C. E. Murray Aynsley's record for Mahseer, 104 and 103 pounds, held good several years, till Colonel Rivett Carnac got his 119 pounder, after which two other fish were caught of 107 pounds each, by Mr. Wet Van Ingen and Mr. Bowring. Mr. E. Van Ingen and Mr. Bowring got 2,573 pounds of fish last season, the best being a 79 pounder to Mr. Bowring's credit, while Mrs. Bowring established a lady's record with two fine fish of 62 and 60 lbs.

)F THE ROYAL SHOOTING AND FISHING IN MYSORE.

21st January to 23rd January 1922.

TIGER.

	Total length.	Height at shoulder.	Sex.	Shot by
a	9′ 3″	3′ 1½″	♂	Colonel Worgan Captain Beddington.

GAUR.

t.	Span.	Spread.	Girth.	Sex.	Shot by
. ..	72″	38″	13″	♂	Capt. Beddington.

MAHSEER.*

re caught.	Weight.	Caught by
ar Kallankote ..	3½ lbs.	H.R.H. The Prince of Wales.
..	18 ,,	Do.
..	7 ,,	Do.
..	6 ,,	Do.
..	43 ,,	Capt. Dudley North.
..	7 ,,	Do.
..	7 ,,	Do.
..	4 ,,	Do.
..	69 ,,	Admiral Sir Lionel Halsey.
..	28 ,,	Do.
..	20 ,,	Captain the Hon. Piers Legh.
..	60 ,,	Do.
..	4 ,,	Do.

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)ther fish were caught of 107 pounds each, by Mr. Wet Van Ingen and Mr. Bowring.
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record with two fine fish of 62 and 60 lbs.

For sometime nothing happened, then the deer began to come through ; and though a fair number of sambhar came by there was nothing shootable, which was just as well as firing might have disturbed the better things to follow.

From the time when the deer appeared it became apparent that for some reason, the game instead of coming up the centre of the valley, as had been intended, were trying to break out on the side where the major portion of the guns were, and in so doing presented targets to the flank guns on that side before they came in view of the " Crowned Heads " near the apex.

The first thing that happened was the arrival of a tiger that was promptly shot by the flank gun on the side in question, then a bear came in view of the next gun on that side and was bowled over in one shot.

After this the Rifle posted at the end seemed to go off like a machine gun as he fired at three more tigers and a bear. One tiger came on down that side and was spotted and laid out by the next gun.

The other two in quick succession broke down the centre of the valley, immediately causing a fusilade to break forth from both sides of the apex of the ravine. It says a great deal for the shooting, that although they were both going at full gallop a good three hundred yards away, they were both bowled over by a perfect storm of shot. It was clear that honours would be divided as it was impossible to tell who hit first.

After a short pause a second bear broke from near the end gun and went across the valley and along under the guns on the far side, being fired at by everyone within range, but apparently escaped untouched.

The beaters now approached as near as was considered safe, and the Indian colonel commanding the beat went forward with a shikari on an elephant to investigate the tigers knocked down in the big fusilade.

They found the first tiger dead. The second they found lying almost opposite the senior members of the party, apparently dead too, and the Indian colonel put his rifle to safe and shouted up to the Maharajah that all was well.

As he did this, the tiger came to life and, in full view of everyone, charged the elephant, before the Beat-commander could get his rifle off "safe," and got on to the head of the elephant. The elephant luckily shook it off and retired hastily making a tremendous noise.

More elephants were called for and when the Indian colonel was having a second go his howdah came loose causing a stoppage, during which six of the party, including the Maharajah and Lord Cromer, came down into the clearing.

On their elephants coming up they mounted and prepared to join in the fray coming in opposite to the luckless Indian colonel who this time came in first and finished off the tiger. The party then proceeded to investigate the other two tigers and the bear which they found dead.

They then returned to Gwalior after a most enjoyable day's sport which was most excellently arranged in truly regal style.

NOTES ON GWALIOR SHOOTING.

A NOTE ON THE TOWER SYSTEM ADOPTED IN GWALIOR FOR SHOOTING TIGERS.

There is nothing particularly scientific about it, and each place has to be treated differently according to its size, depth and situation with reference to other valleys.

The 'towers' are usually of circular shape and are erected on one of the slopes of the *Kho* or valley in which the tiger lies up. The beast is located by the 'kill', a buffalo tied up as bait, and a line of beaters is employed to drive it out past the tower in which the guns are posted.

"A guide to tiger shooting" by H. H. The Maharaja Scindia gives the fullest details in all that pertains to arrangements for Tiger Shooting in the State in reference to Mala, Machan, and Baits, Stops and Flankers, the Beat, etc., etc.

TIGERS IN GWALIOR.

Although Gwalior is famous for the number of its tigers, very few people are killed by them. A mad woman who had ventured out was killed by a tiger near the nullah at Rampura where the shoot took place on Thursday, February 9th.

Tigers are so common that one was shot recently in the Maharaja's palace grounds and also one in the Morar State Post Office about four miles away from the palace. The first had scaled the huge wall which surrounds the palace ground and afforded great sport, and excitement before it was captured. The second was shot by Sardar Bahadur General Abdul Ghani but the story that it had eaten a lot of postage stamps is not correct. Tigers are on the increase in Gwalior as the breeding grounds near the Kuno river are never shot. There are probably just now from 400 to 500 tigers in the State and the number is probably going up.

NOTE ON THE FAUNA OF GWALIOR.

The Gwalior Forests abound in big and small game and special rules embodied in the Forest Act and Shikargah Manual, the famous little book brought out by the Maharaja Scindia, have helped towards the preservation of Fauna to an appreciable extent.

Gwalior State cannot be considered rich as regards its Mammal Fauna when compared to certain other parts of India such as Assam, Burma or Southern India. Still it has a fair number of species though nothing of outstanding interest. The reason for this is of course due to the fact that there are no really heavy jungles in the State, the jungle here consisting either of stunted teak or babul. Another cause, which probably contributes not a little to the poorness of the mammal fauna, is the number of guns in the hands of the villagers. The natural result of this is that every animal remotely edible is ruthlessly slaughtered, and a country so eminently suited to the black buck and the chinkara holds comparatively few of these animals.

FORESTRY IN GWALIOR.

The Gwalior Forests which are particularly suited for Shikar are neither too dense nor too open, so that beasts of prey find in them congenial homes in all seasons of the year.

I was told that in the hot weather, in spite of the rigour of the climate, the attractive picturesqueness of the forests is set off by the presence of perennial streams and rivulets rendered translucent by mid-day sun and the effect is heightened by abundant growth of *Euginias* and *Ficus* species along the banks.

TYPICAL GWALIOR TIGER JUNGLE.

A TIGER NULLA—GWALIOR.

I saw no streams at all however round Rampura, Bhinwara or Bamora, the places where shooting took place. Everything as I have already remarked was very dry and arid, and the big nullah beds were completely devoid of water.

It is quite characteristic of these forests that a shower or two suffice to completely alter their aspect. Just like ever green or coniferous forests, these forests are not malarious excepting for some months during the rainy season and this factor makes them accessible all the year round.

Colonel Haksar of Gwalior writes : "The principal species in the forests are *Boswellia serrata*, *Sterculia urens*, *Odina wodier*, *Anogeissus latifolia*, *Anogeissus pendulla* with other auxiliary species of *Diospyros tomentosa*, *Buchanania latifolia*, *Zizyphus xylopyra*, *Terminalia belerica*, *Aegle marmelos* and Bamboos. *Terminalia chebula* was once a common tree in these forests as the legend goes and a few remnant trees testify,but now it has become more or less extinct. *Bassia latifolia* is one of the most useful and important trees of these forests as it does not only yield timber suitable for agricultural implements but also yields the famous Mohwa flower and Mohwa seeds so essential to rural economy and of such great commercial value. This tree also grows on good soil on the plains or at the base of the hillocks. The tree rather lacks the power of natural regeneration which augurs ill for the interests it serves. The forests in the vicinity of the shooting districts constitute the extreme northern fringe of the great tract of deciduous forests of dry type which cover most of the Central India plateau.

The country is traversed by the Vindhyan Range running in a north-southerly direction. These hillocks, naturally before the development of the country, were thickly covered with dense forests but, as new industries sprung up, cultivation extended, and consumption of wood increased, these forests were practically denuded. The effect of the recent introduction of forest conservancy measures in Gwalior is already becoming visible—in the bare hillocks getting covered with grassy growth, a growth giving a footing for "Pioneer Plants" of *Boswellia* and *Nuclanthes* which in nature are precursors of more economic species of *Acacias*, *Anogeissus*, *Buchanania*,*Diospyros*."

All the various interesting stages of forest evolution are represented in these parts in regular succession, and Col. Haksar says "one has to go round the capital of the State and further south to draw a deduction from this natural practical demonstration of 'The formation of forests' and 'rotation of species'." Continuing he says "The geological formations of the Vindhyan series near about Lashkar are equally interesting. The hillocks are of various heights and the country rises as we move southward till it again becomes an open plain a few miles south of Shivapuri. The plateaus of hillocks in the vicinity of Lashkar are covered with a variety of grasses of which *Sain* is the most noteworthy. The valleys are in most cases richly wooded and represent in general the economic flora of the country. The sides and the slopes of the hillocks are covered with hardy species but in their south-western aspect, as one would expect in these latitudes, the growth is comparatively poor."

From the pictures given in this account one can obtain some idea of the districts covered by the forests in the low-lying country of Gwalior as it was seen by the writer in February 1922.

III. PATIALA.

H. R. H. The Prince of Wales was at Patiala from the morning of the 22nd of February till the evening of the 24th.

Originally a shoot had been planned for the visit in the Pinjaur jungles, some fifty miles distant from the city of Patiala, situated on the State boundary between the lower Himalayan Mountains and the Siwalik range. Much sport would have been enjoyed here as Tiger, Panther, Sambar, Chital, Hogdeer, Goral, Barking Deer, Black Bear, Blue Bull, Wild Boar, Hyænas, Kalij Pheasants, Jungle Fowl, and Grey and Black Partridges are plentiful.

In 1918 Lord Chelmsford, and in 1920, the Crown Prince of Roumania, had very successful shoots in this district.

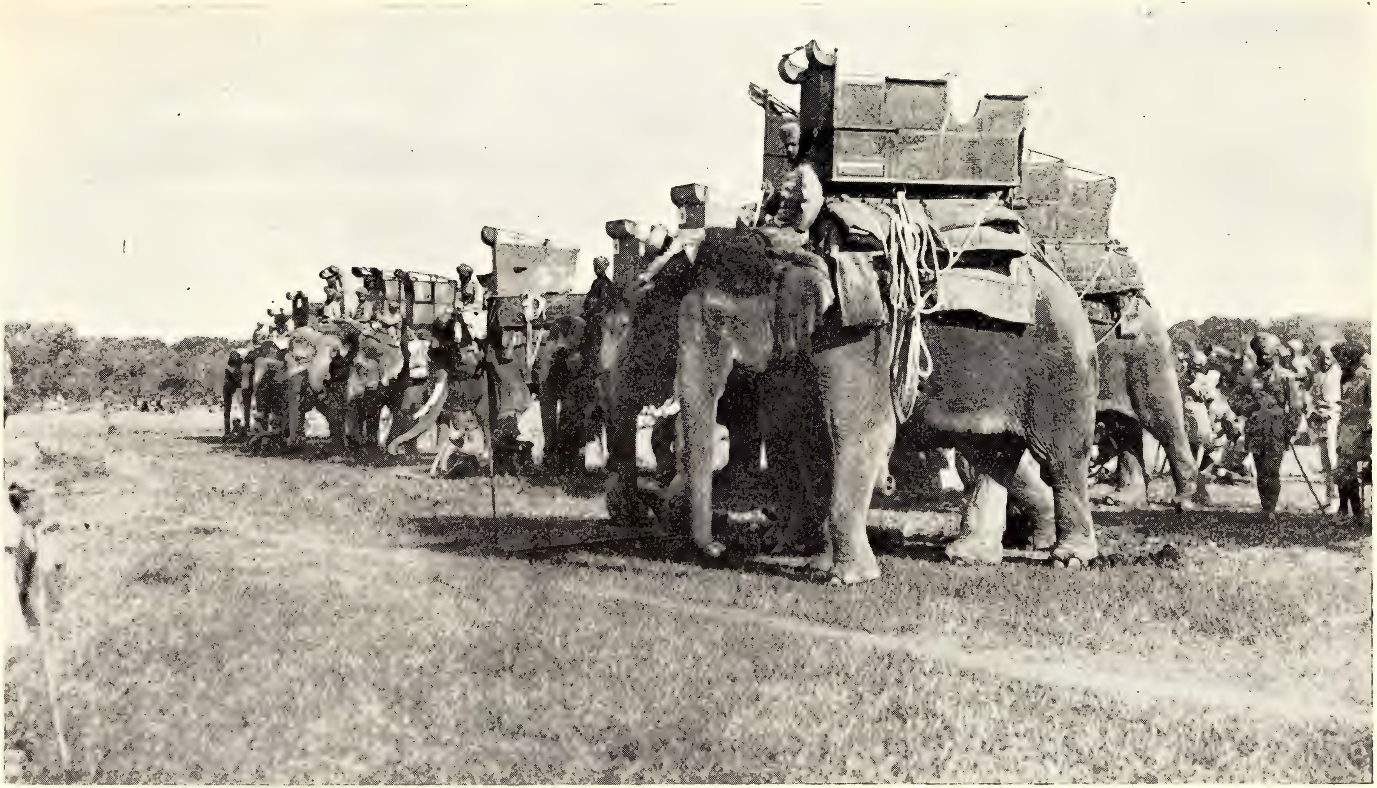
Owing to the limited time of the Prince's visit, it was definitely decided to have the shoot arranged near Patiala, *viz.*, a general shoot from elephants at Bunerhari, and Pig Sticking in Sanaur and Bahadurgarh.

Formerly around the city of Patiala there used to extend a thick scrub jungle, and it was impossible to cultivate the land owing to the number of wild animals of all descriptions. Later orders were given to exterminate them and to burn down the jungles. Since then few places have been reserved for shikar purposes. The last tiger was shot in these parts in 1907, but panther are often shot. Recently just before the Prince's visit two were shot in the deer park behind the Moti Bagh Palace. They were enticed down from the higher ridges of forests by the Chamba or Oade Shepherds, who pass through Patiala territory with their flocks of sheep. The jungles are strictly reserved and looked after by the Forest and Shikar departments jointly.

Many improvements have been carried out according to H.H. the Maharajah's own ideas, such as experimenting by introducing foreign game birds and animals. The results have been good, the Maharajah told the writer, and some of them have thrived very well and have commenced to breed. Under the strict game laws in vogue, both big and small game have increased.

Most of the time in Patiala given to sport was devoted to Pig-sticking and Polo, but on Feb. 24th, a limited number of guests were invited to a general shoot. This was arranged by Mr. Hutton, officer in charge of the shikar department, under the direct instructions of H.H. the Maharaja Dhiraj. As it was to be on a very large scale, and the number of elephants was limited, lots were drawn among all the guests, including the ladies, who were to watch the shoots. At the very commencement of the ball every one was warned, especially the ladies, that they would have to be ready at 7 A.M. to proceed in cars to the shoot. Accordingly the next morning in spite of many people having had very little sleep, a very large and jovial party arrived from the various tents and the guest house near the Palace, and got into the cars and motor wagonettes which were lined up waiting. The Prince of Wales, Lord Cromer, Sir Geoffrey deMontmorencey, Captain Metcalfe, Lord Louis Mountbatten and others were not going, but had gone out pig-sticking. The people who were up very early, or who did not go to bed at all after the ball were lucky to snatch a hurried breakfast, but most people and the writer was one, were not so fortunate. A drive out of Patiala to a place called Bunerhari, seven miles East of the city, was soon accomplished by the various motor cars and charabancs. The country was very flat and uninteresting, and was crowded with villagers dressed in holiday attire, who watched us with great interest as we passed.

Bunerhari is a small village situated amongst pretty and picturesque jungle. There was a small rest house or shooting lodge on the outskirts of this and everyone got out in front of the house as all the elephants were waiting here. One of the elephants used (a huge tusker) was the one Lord Hardinge rode on the occasion when he was bombed in Delhi. The back of the howdah was blown away, and the marks could still be seen of the wound the elephant receiv-



Some of the elephants of the line at Patiala.

ed. Behind the shooting lodge in question, laid out on the ground, and under the charge of Shikaries, was a magnificent selection of the Maharajah's rifles and guns. Most of these were by well-known makers, and were fine specimens of gun work; some had the Maharajah's effigy in mosaic, or enamel on the butts; and all were emblazoned with his arms. There was a colossal display of ammunition and cartridge bags. It was simply a question of take what you please. Most people selected shot guns, and some people took rifles too, although it was prophesied that in all probability small game would be the order of the day.

The beat commenced immediately the members of the Prince of Wales staff had arrived. Everybody was given an envelope; inside which was a number which corresponded with a large one placarded on the howdah elephant, he or she was to occupy. There was another sheet of paper on which were printed the names of all the game that could possibly be shot here, and places left for filling in and for signature. These printed lists were to be filled in and entered, even for such animals as porcupine and goggle-eyed plovere (stone-curlew). One of the party was perfectly certain he would not know a goggle-eyed plover if he saw one. He was on the point of putting down a big round 0 against this item straight away, when it occurred to him that he might possibly shoot one by mistake when firing at something else. Everyone mounted the howdahs, two ladies behind as sightseers, and two men in front with rifles and guns. After it had been ascertained that game cards had been distributed to everyone a move forward was commenced. It was now 8-30 A.M. and the howdahs proceeded along a bridle path through scrubby jungle for about a mile, and then stopped by some red flags. They were then separated at a distance of about twenty yards from each other. Between each howdah was a large card posted up which corresponded with the number on the elephant. All the elephants were then lined up in a continuous line, and this stretched for a very great distance. In addition to an army of beaters behind us there was also a vast array of cavalry with spears making altogether a most imposing and warlike spectacle. Bugles then gave the signal to advance, and an idea of the scene then presented can be gathered if one were to look at the picture of the Kadir in a recent sporting number of the *Sphere* published for the Prince of Wales' visit to India. Magnify this picture twenty times, and one has some idea of this great array. The machine starts, for the movement of the elephants in a cavalcade of this description may be compared to the slow movements of the cogwheels of a huge machine. The sportsmen on the howdahs, with ladies all on the 'qui-vive,' followed by regiments of cavalry, and in their turn followed by a masterly array of beaters and shikaries ready to pick up any game is the formation, all help to complete an unforgettable picture.

Try to visualize this and the reader has before him the great mixed shoot provided by the Maharajah of Patiala.

Indeed as the array gets in into motion and proceeds silently over the open ground, with not much stretch of imagination one might imagine the return of Pompey's triumphant armies from the wars. (Elephants, horses, and even camels are in use).

We had not gone far along the flat plain broken here and there by shrubs, small nullahs, dry for the most part, with the exception of some parched grass, before we came across the first object shootable. On the preceding day I witnessed in similar country the driving of pig out of the scrub-district into the open, where the men on horse back were waiting for them. This had shown how thick ("lousy" as a prominent pig sticker described it when speaking to me) the country was with pig. So it was only fitting that the first animal that came out should be a wild boar. A hog got up out of the bushes some yards ahead of my howdah, and although several shots reached him from those nearest, who were standing up, he was able to make good his retreat. When two people are crushed together in a howdah, and the elephant is moving, it is extremely difficult to shoot with anything like accuracy. Nevertheless some members of the party, as the records show, gave a very good exhibition of shooting, particularly with small game, bringing off their rights and lefts, time after time, with considerable adroitness and accuracy. Some quail were flushed and then some sandgrouse.

The first item shot of any importance was a panther. We were proceeding through some jungle, chiefly composed of cactus, when some one saw what he thought were the eyes of a panther in the shrub, and immediately opened fire. No movement however was observed in the bushes, and everyone thought that the panther, (if a panther it was) preferred to keep earth. Several howdahs surrounded the bushes, and poured volley after volley into them. After some minutes as nothing happened one of the shikaries, bolder and more venturesome than the rest approached the cactus gradually, and at last turning aside some of the leaves disclosed a fine pard badly hit. The whole incident was most strange and unpantherlike !!

A fine Nilgai cow was espied looking in very truth a "blue bull." She was about two hundred yards away and, after standing and gazing at us with that peculiar deflection of the neck which one so often sees in mounted specimens of Nilgai heads* in museums, trotted off down the line at a good pace. For the next hour or two we moved over alternately scrubby jungle, and ground akin to moor land, and every now and again got into open country. Sport was very good. According to the different country we got different kinds of game. In the first part mentioned panther, wild boar and hog deer. In the next partridge, quail, pigeon, peacocks and plover, and finally black buck and nilgai, etc. The whole time there is a perfect fusilade resembling the systematic popping off of machine-guns. Nearly everyone bags something or other; sand grouse, quail, pigeons, partridge, etc., are most plentiful. Even my poor gun manages to bag a few birds. In the open country pig repeatedly offer good sport as they are driven out of the bushes, and often with many squeaks, a whole crowd of little pigs scuttle away in the distance with their harassed parents; black buck were also extremely plentiful. I saw some quite good heads but none were killed. Peacock and Peahen offered a very tempting target, as they flew over our heads, but we were not in Nepal, and hospitality has its laws. However one member of the party could not restrain himself, and down came a peacock to the intense amusement of everyone. It was really an accident "Fifty rupees fine or a month's imprisonment", the Commissioner, who was shooting near by, announced amid peals of laughter. At about 12 o'clock the line wheeled round, and we returned by a different route, getting back to our starting point at about two o'clock. Colonel Worgan had a nasty accident of which we knew nothing till afterwards. His rifle, which was standing on end in the howdah, while he was using his shot gun, suddenly went off. The bullet split on the iron rail of the howdah and several pieces of the bullet went into his hand. The accident seems almost inexplicable, and it was very lucky that he got off so lightly.

As the bag shows, everybody had splendid sport and quite, contrary to many shoots, there was no tedious waiting about or sitting up in machans. Everybody had good fun and there was not a dull moment in the whole five or six hours, firing going on with varying intensity on some section of the line the whole time. Everything was done so smartly and briskly. A bird was shot. It was immediately picked up by a beater, given to the owner who put it in the net supplied for that purpose hanging on to the back of the elephant. If larger game—a pig for instance—were shot, a label was immediately put on it coinciding with the note made by the owner on his game card. All these cards were collected at the end of the shoot for purpose of reference and statistics. I cannot speak too highly of the wonderful precision and accuracy with regard to every detail of the shoot. Much thought and care had been expended by our generous host, the Maharajah, and reflected great credit on his shikar department.

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*In the Prince of Wales Museum of Western India, Bombay, our Natural History Society have two Nilgai heads mounted which clearly illustrate this point.

Everybody was in excellent spirits and when birds were repeatedly missed, or incidents happened such as a donkey or camel breaking loose and dashing into 'No mans land' there was a cheer the whole way down the line. Everyone was sorry that the Prince was not present, as the fast and rapid sport of the day, when everybody stood an equal chance, would have been to his liking. H. R. H. had good sport with pig, and killed a boar with one spear, a feat to be very proud of, but unfortunately the pages of this article have to confine themselves to shooting and "*obstat*" stands facing me if pig-sticking is mentioned.

* * * * * * * * *

CONCLUSION.

In attempting to compile these records I had other views in mind besides that of a mere narrative of yet another of the many and various activities that have fallen to the lot of the Prince of Wales.

Besides trying to describe the actual incidents of the shoots, I have added the bags with detailed measurements, and in some cases my own remarks. Throughout I have tried to write from a Natural History point of view, and have supplied many field notes which will, I hope, interest the Zoologist and the Botanist. I hope that these notes describing modern methods of sport in very different regions of India may be of value, not only as a record of the past, but as a guide for the future. It is not likely to fall to the lot of many readers to enjoy the opportunities of H. R. H., but those whose shooting is on a much humbler scale may be glad to know the full resources of the jungles, and how under the most ideal circumstances they can best be shot.

To thank everyone who helped in this compilation would be a lengthy and difficult matter.

Besides Sir Geoffry de Montmorency I have to thank the different members of the Prince's staff, Colonel Burton, General Kaiser of Nepal, Mr. R. A. Spence, M.L.A., Sir Henry Macnaghten, Rev. E. Blatter, S.J., F.L.S., and the writer's colleague, Mr. S. H. Prater, Major Stockley, D.S.O., Mr. Charles M. Inglis, Lieutenant Commander Hopkinson R.N., the authorities in Bhopal and Mysore and Mr. Theobald, Mr. B. V. Rama Iyenger, Mr. Kingsley and Mr. G. W. Milroy of elephant fame, and Messrs. Van Ingen and Bowring, famous fishermen in India, Their Highnesses the Maharajas of Baroda, Gwalior, Bikaner and Patiala and Mr. Jardine and Colonel Luard again for all their kindness and help. It is owing to the kindness of Messrs. Barton Sons of Bangalore that several fine photos in connection with the elephant kheddas are given.

In conclusion I regret that for financial reasons many of the splendid shikar photos in my possession are unable to be reproduced.

RECORD OF THE SHOOT IN PATIALA, FEBRUARY 1922.

Howdah No.	Hare	Quails.	Pea-cocks.	Black Part-ridge.	Grey Partridge.	Panther		Wild Boar.	Porcu-pine.	Pigeon.	Hog Deer.	Stone-Curlew.	Total.
						No.	Measure-ment.						
1	1	1	..	..	14	..	..	..	..	..	..	..	16
2	1	..	..	..	9	..	..	..	..	..	..	..	10
3	2	1	..	..	8	..	..	..	..	..	..	..	11
4	1	1	..	..	4	..	..	..	..	..	..	..	6
5	1	3	..	..	6	..	..	..	..	..	..	..	11
6	4	..	1	..	11	..	..	..	..	..	1	..	16
7	1	1	1	1	15	..	..	..	..	..	..	..	19
8	1	3	..	..	6	..	..	..	..	..	1	..	11
9	3	..	..	..	7	..	..	..	..	..	..	..	10
10	..	1	..	..	3	1	5′—8″	..	..	..	..	..	5
11	..	1	..	..	3	..	..	1	..	..	..	..	5
12	5	..	..	..	5	1	6′—7″	..	..	2	..	..	13
13	2	1	..	..	4	..	..	..	..	..	..	..	7
14	..	1	..	13	3	..	..	..	..	1	..	..	18
15	5	1	..	..	15	..	..	..	1	..	1	..	23
16	..	3	..	..	8	..	..	..	..	2	..	..	13
17	3	1	..	..	4	..	..	..	..	..	..	..	8
18	3	..	..	..	9	..	..	..	..	..	..	..	12
19	2	..	..	5	..	..	..	2	..	..	..	1	10
20	..	..	..	6	12	..	..	3	..	..	..	..	21
21	2	..	..	2	5	..	..	..	..	..	..	..	9
Total.	37	19	2	27	151	2	..	6	1	5	3	1	254

THE MEASUREMENT AND PHOTOGRAPHY OF SPECIMENS OF BIG GAME.

BY

MAJOR C. H. STOCKLEY, D.S.O.

(With photo and 3 plates.)

MEASUREMENTS.

It is a regrettable fact that the use and object of measuring big game, namely, the advancement of knowledge, has very largely been lost sight of, having been obliterated by the spirit of competition which is steadily destroying true sportmanship; so that to a great many big game hunters the enjoyment obtained from a trip is almost entirely estimated by the number of inches by which their trophies exceed those of their neighbours in length. I have heard a man, on his return from Baltistan, declare that he had had poor sport, and then admit that he had shot four ibex over 40 inches each, but that he did not consider that he had had good sport because two brother officers had each got a bigger head (by an inch) than he had. Often a man who has got an exceptionally fine trophy on his first trip, will openly say, or infer, that he thinks himself a better shikari than another man whose bag is of good heads above the average *without a small head amongst them.* That is the true criterion of a good shikari, he never shoots an undersized head. Naturally the bigger the trophy the better most of us are pleased, but bare measurements often convey little.

Take the Kashmir Stag for instance. The so-called record measures 51 inches, it is now in the possession of Mr. C. S. Rogers, I.F.S. It is of interest because of it's abnormal length, but is a straggly, uncouth-looking, pair of horns, not to be compared with several other fine heads of less length which I have seen; notably Mr. Vander Byl's grand 47½ inch head, which is illustrated in Rowland Wards' "Records of Big Game."

Again, the horns of an old bull Gaur often wear down to such an extent that they lose a third of their true length. Can anyone think that the thin narrow head of a young bull can compare with the wide massive horns of an old veteran, just because the horns of the young bull measure an inch or so more in length!

Measurements are meant to tell us what is the average size of a fully adult beast: what localities and what conditions produce the greatest growth of horn or body: how long a beast takes to reach maturity, and many other such interesting things. To measurements add a good photograph and the museum worker, the taxidermist, the reader of the Journal, and the man-in-the-street, can get a good idea of beasts which they may never see in the flesh. Many of the monstrosities, in the guise of mounted specimens, which are to be seen in museums, might instead have been lifelike representations if the taxidermist had had a good photograph and accurate measurements to help him.

How to take measurements.

Horns.

A. Stags. Measure from the base of the burr, up the back of the horn for the length.

The girth of the horn is measured at its thinnest point below the "crown" or main top tines. With the red deer group it is often taken between the two lower tines, (brow and bez), or even round the burr: both these measurements are valueless, as a poor horn is often quite thick at these two points and thin in the main beam.

Then measure tip to tip.

Then the "widest inside," *i.e.*, the greatest width between the main beams.

Lastly, take the "widest outside", which is the greatest outside measurement from tip to tip of corresponding tines: this measurement is the "spread."

B. Antelope. Blackbuck are measured straight. The head should be put face down on a table, and a pencil mark made at the points immediately under the base and tip of the longest horn. The distance between these points gives the length measurement.

All other antelope are measured from base to tip over the front curve.

The girth is taken round the base, and the tip to tip measurement is also taken.

C. Buffalo, bison, etc.

There is much divergence of opinion as to how these should be measured, but as it is spread and girth which are the most desirable attributes of trophies of the ox tribe, these measurements are always taken.

1. *Spread, or widest outside.* Place the head face downwards on a table. By the aid of a visiting card placed vertically against each horn at the outside of their greatest width mark the greatest width on the table, and measure between these points.
2. *Widest inside.* Taken the same way on the inside of each horn.
3. *Tip to tip.*
4. *Length.* As most old bulls have their horns much worn down at the ends, this measurement is not of very great value in appraising a trophy. It is taken from the lowest point of the base of the horn, over the outside.
5. "*Sweep*". The same remark applies to this measurement as to that of length. It is taken from the tip of one horn, round the curve and across the forehead to the tip of the other. It merely amounts to the total length of both horns, *plus* the width of the forehead. The larger figures which result are imposing to some people I suppose.

Body Measurements.

Lay the animal flat on its side pulling it out as straight as possible, but releasing it so as to get it naturally relaxed. Put pegs in at its nose, the root of its tail, and the tip of the tail (excluding the hair). Then put in pegs at the top of the shoulder, and at the *heels* of the forefeet, placing both heels together and getting the legs in as near the natural standing position as possible.

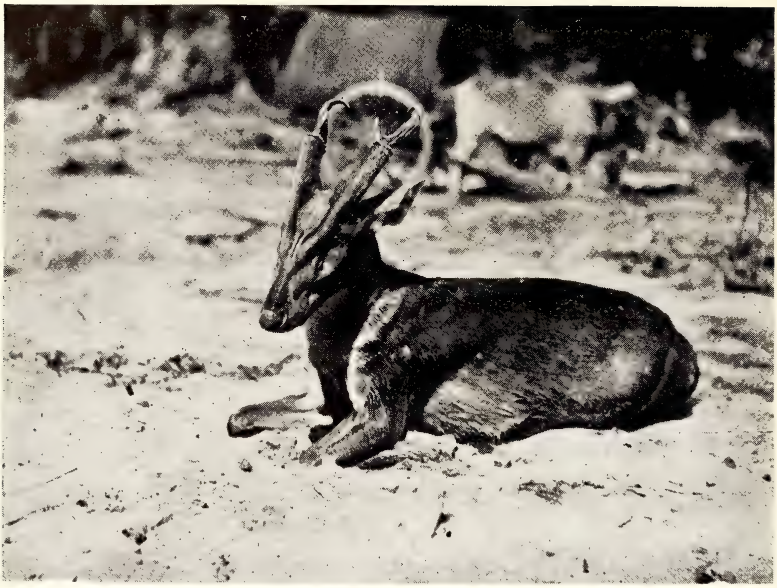
Measure the shortest *straight distance* between the pegs.

1. Nose to root of tail, giving length of body.
2. Root to tip of tail, giving length of tail.
3. Nose to end of tail, giving total length.
4. Height at shoulder.

The girth of neck and chest are often useful measurements.

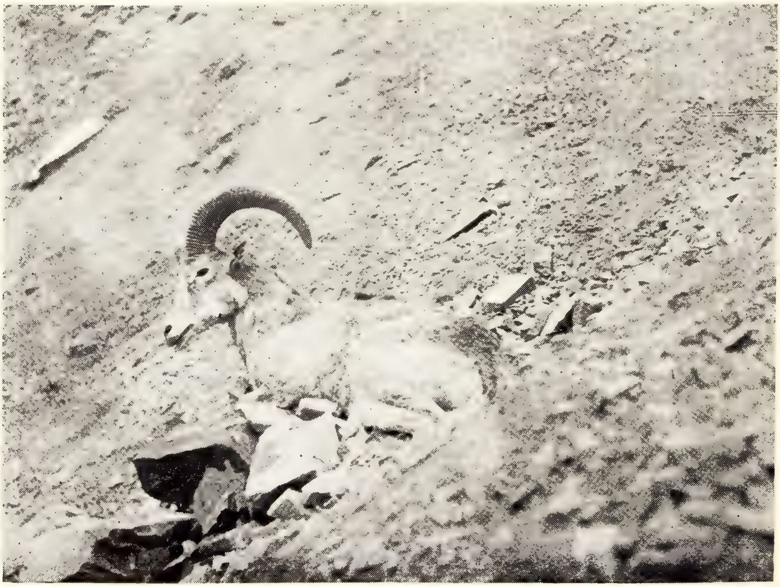
It is often advisable with animals which are difficult to pull out straight, such as goats, antelopes, to measure chest to rump. This measurement and the height at the shoulder, if taken carefully, give the true proportions of the animal. If the specimen is for mounting complete or with the mask the length of ear should be recorded.

Curve measurements are useless. I once measured a panther three times over in front of a man, who denied that curve measurements are



BARKING DEER.

Correctly posed.



SHAPU (*Horns* $26\frac{1}{2}'$).

Correctly posed.

unreliable. The three measurements differed by over two inches, although as my critic admitted, I took great care in making them.

A pegged out skin of a $5\frac{1}{2}$ foot bear will measure 7 feet with only ordinary stretching, and not attempting to obtain a great length measurement. The only comparative measurement I have of tiger, is of a tigress which measured 8ft. 3in. straight, and 10ft. exactly when pegged out. A 7ft. $1\frac{3}{4}$in. panther measured 8ft. $11\frac{1}{2}$in. pegged out, but had been carried to camp on a pole before being measured, and was stiff and could not be pulled out quite straight.

PHOTOGRAPHY.

It is very rarely one sees a good photograph of a game animal, taken after death, yet they are easy to obtain with a little trouble, and are well worth the trouble in the addition they make to the memories and records of the shoot.

The most common fault is to take the photograph with the animal directly facing the camera, so that all that is seen is a badly focussed picture of the head, out of all proportion to the rest of the animal. Another common fault is to take the whole animal lying down on its side with its legs stretched straight towards the camera, so that the feet and light-coloured underparts are most conspicuous. The animal is also often pulled out stiff and straight, so that the legs appear much too long and the whole aspect of the beast is most unnatural.

The first object of the photographer should be to get his subject into as natural a position as possible, keeping in mind the fact that an animal is in life lissom and curved, not stiff and straight.

The attaining of a natural appearance is fairly easy with animals such as tiger, panther and bear, as the best one can do with them is to lay them out in the nearest to a crouching attitude obtainable. With goats, sheep, etc., it is possible to be more elaborate, especially with those which are not overweighted in front with very large horns.

The only accessory needed is a forked stick. This should be cut about 18 inches long, the fork being not a true V, but with arms of about five and seven inches in length. The lower arm should be inclined slightly upwards from the stem, the upper arm being bent about ten degrees from the vertical and forming a right angle with the lower.

Place the animal to be photographed in a sitting position, the legs being tucked in parallel to the body on each side, as naturally as possible. To keep the animal steady it is often a good thing to place him on a slight slope, the hill being on the far side from the camera. Stones and lumps of earth can also be packed under the beast's far side to support it. To support the head, place the lower limb of the forked stick under the lower jaw, the point of the arm resting against the inner side of the jawbone. The upright and longer arm of the stick should be arranged so that the point rests under the base of the horn on the far side or under the base of the ear, according to the size of the animal. The butt of the stick can be fixed into a small hole scraped in the ground, or into a crack in the rock, or rested on a stone. It is not necessary that the stick should be absolutely square with the head; it may be placed a little to the rear, so as to avoid its appearance in the picture.

The animal should be arranged almost, but not quite, broadside to the direction of the light, and the photo taken from a position slightly in front of or behind it. The point from which the exposure is made will depend greatly on the build of the animal and the shape of its horns, also on whether it has any special features which it is wanted to emphasise.

Big beasts like bison and tsine, are too heavy to arrange with the forked stick as a rule, but it might be done under favourable circumstances. Most stags are rather top-heavy, owing to their horns, so are placed with the head resting on the ground; a stone or stick on the far side will keep the head from toppling over. A needle and khaki thread, by which the ears can be tied up to the horns so as to prevent them flopping down limp adds to the naturalness of the pose with many gazelles.

Before making the exposure hold the camera low down and see that there is no grass, etc., which obscures the lens. Remember that the view-point of the lens is a foot or more below that of the photographer.

It is usually best to let the subject fill about two-thirds of the picture, so that there is room for some of the surroundings. This will also mean that the photographer does not get too close, and all parts of the animal will be in focus, and also probably the nearer portions of the background.

Patchy light should be avoided. It is easy to increase the exposure, even in deep shade, resting the camera (if there is no stand) on a bough, rock or dead tree.

Under-exposure is much commoner than the reverse when taking photographs in the jungle, and animals are so coloured as to render a very full exposure desirable. Even in what appears to be the brightest light, when in an open glades in the jungle, the green from surrounding trees affects conditions so greatly that exposures have to be increased up to 50 per cent. above the normal.

I always take two or three exposures of any animal, if I have no previous photo of the species, or it is a specimen of which I particularly want a good record.

With hill animals it is often difficult to find a good position to stand for the photograph, but in the case of the smaller ones, there should be no difficulty in moving them to a suitable place.

Tastes in cameras vary as in everything else, and the best one can afford is the one to use. Postcard size or 5″ by 4″ give the best results as a rule; the latter size is the one I personally prefer.

Printing and enlarging photographs.

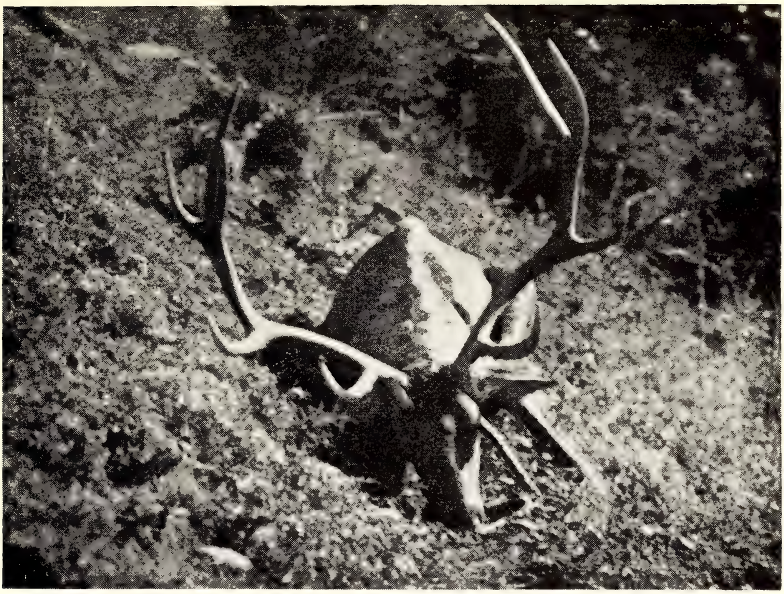
The average photo of a game animal prints best in bromide gaslight paper, but where exceptionally good negatives have resulted silver prints are the best. Silver prints are also the best when photos are sent for reproduction in the press.

Enlarged photos of big game are very useful for adorning the walls of a bungalow, especially when hung under the trophy they illustrate, or a collection can be made and kept in an album. Enlargements are usually made on bromide paper. Carbon enlargements give the finest results and finish. 10″ by 12″ is a useful size.

Colouring enlargements.

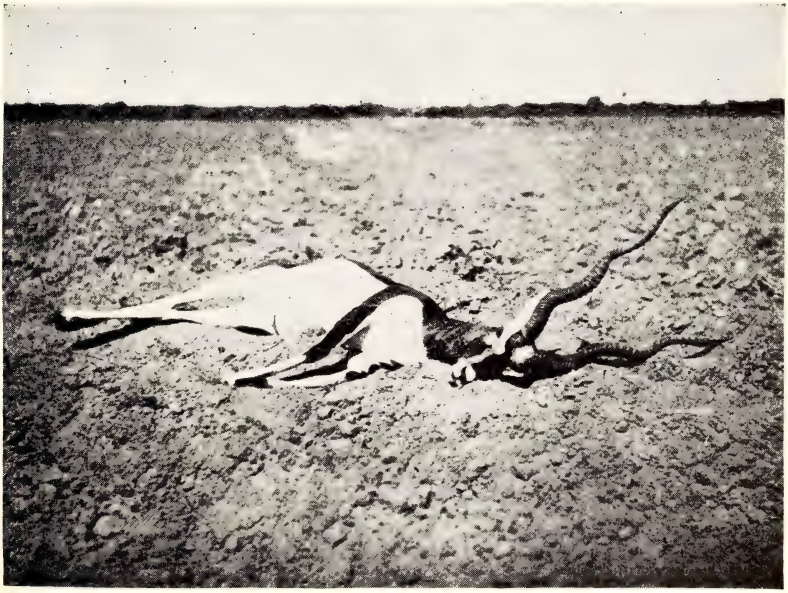
It adds very greatly to the value and beauty of an enlargement to colour it.

This is quite simply done with oil colours, as follows:—The materials needed are (1) a quantity of clean cotton wool, (2) a small bottle of linseed oil, (3) a tube of each of the following colours:—Indian Yellow, Chrome Yellow, Cobalt Blue, New Blue, Rose Madder, Light Red, Burnt Sienna and Vandyke Brown. Additions may be made to this list later on if desired, but these are sufficient to begin with. Tubes of oil colours cost from As. 8 to As. 14 each.



1.

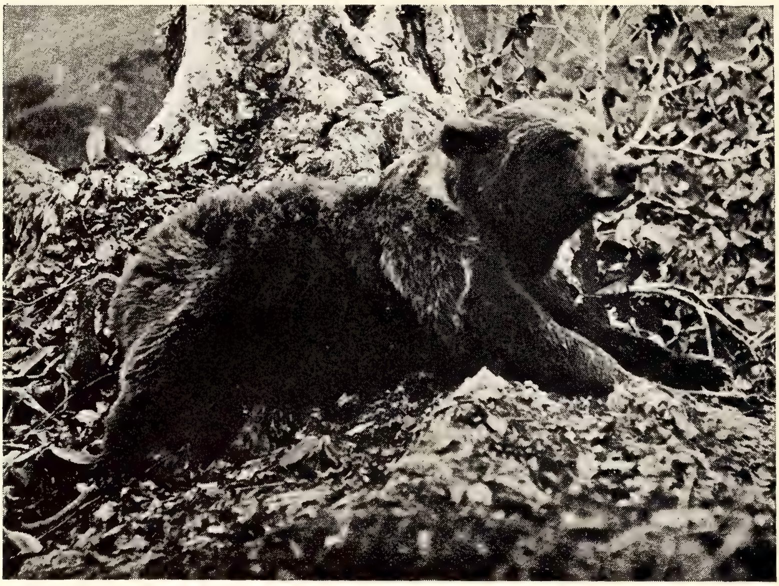
KASHMIR STAG.
Badly fore-shortened.



2.

BLACK BUCK.
All legs and underparts.

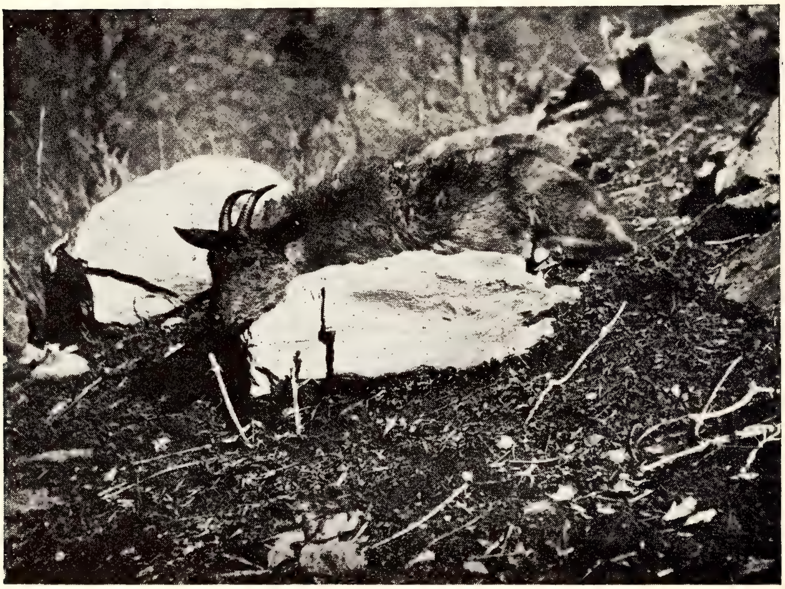
The fore-shortening of the Kashmir Stag exaggerates the apparent size of the horns which measured 41 inches. In both photos the natural colouration and build of the animal is obscured.



3.

BROWN BEAR.

Frozen stiff before posing.



4.

GORAL.

Back broken by bullet, and badly smashed by 400 feet fall.

The above are examples of the best that can be done in certain cases. The bear was shot when it was too dark to photograph and was left out overnight.

The Goral was too smashed up to pose properly.

To colour an enlargement.

Select a bromide or gaslight enlargement with a matte surface: a very smooth surface will not take the oil. The shadow should not be too deep or the print a very dark one.

A bare deal table is best to work on.

Pour a little linseed oil into a china palette or saucer. Dip a pad of cotton wool into it, and rub the oil all over the print. See that the oil covers the whole of the print, but do not let it be too moist. It is often best to give the print a second rub over with clean dry wool, to remove the superfluous oil.

Squeeze a very little of the colour needed on the palette or saucer, and rub it on to the print with a screwed up piece of wool. Where the colour extends beyond the intended area it is wanted to colour, it is easily wiped off with another piece of wool lightly dipped in linseed oil.

It is usually best to do the sky last, as then the colours can be cleaned off where they have encroached, and the sky put in clean right up the horizon.

Greens must be mixed on the palette, most of them being based on Indian Yellow and New Blue. The sky is tinted with Cobalt. Water is various shades of green, except where it reflects the sky, which can only be arrived at by experiment.

Vandyke Brown colours tree trunks and dead wood, while Burnt Sienna gives all "tawny" shades with or without a little Chrome. A light shade of Burnt Sienna is the right thing for tiger, which is not yellow as it seems at first sight.

A little perusal of the elements of colour-mixing, as set forth in any cheap book on painting, is of great assistance.

Put in the fine detail with a brush, first thinning down the colour with a little linseed oil.

When the colouring is finished put the print away to dry where the dust will not get at it. Drying takes about four hours as a rule.

The whole process is remarkably simple, and suited to any type of picture. It is not very lengthy : an average print takes about three quarters of an hour, one with a geat deal of detail perhaps half an hour more.

The cost is negligible, as a tube of colour lasts for at least fifty photographs : I have not discovered the limit.

SOME NOTES ON THE HABITS OF THE CEYLON GERBIL, *TATERA CEYLONICA.*

BY

W. W. A. PHILLIPS.

(*With a Plate and a text figure.*)

Singhalese—*Well-miya* (Field-Rat).
Tamil—*Vell 'elli* (White Rat).

THE CEYLON GERBIL OR SAND RAT (*Tatera ceylonica*).

Judging by Blanford's account (Fauna of British India—Mammalia page 396) the habits of the Ceylon Gerbil seem to differ somewhat from those of its close relatives on the Indian mainland.

The following notes may therefore be of interest; but it must be clearly understood that they apply to the habits of the animal in the Kalutara District only;—as in the drier, and less thickly populated districts of the North, East and South these habits may be modified to some extent.

The Gerbil is found all over the low country, both in the dry and in the wet zones; but does not seem to ascend the hills at all. The highest altitude from which it has, as yet, been recorded, being only about 600 ft. above sea level.

Kalutara is in the wet zone of the West Coast, and the locality where these notes have been made has a rainfall of about 110 inches per annum.

The Gerbil or 'Sand Rat,' as it is usually called locally, is by no means uncommon and, were it not for the Tamil cooly, would be very plentiful. It lives in one of two places—either in a white ant hill or in a burrow in soft sandy soil. In the ant hill it is quite fairly safe as, the soil being so hard, no animal can possibly dig it out and it is only with much labour that the cooly can get at it—either by breaking down the whole hill or by smoking it out. It must, however, be very liable to attacks by snakes—such as the Rat Snake (Dhaman) and Cobra—which frequent these places and it is probably for this reason that it prefers to live in the open, in burrows of its own construction. It seems only to retire to the ant hills when driven out of its own burrows and, as far as I am aware, never breeds there. It will often live in an ant hill when constructing a burrow in some convenient spot close at hand—retiring to it during the day and working on the burrow each night—for it is a purely nocturnal animal.

I have never yet found more than one family in an ant hill and it is the exception to find more than one adult in any burrow. The old male will often live by himself, in a burrow of his own, but is sometimes found in an ant hill with a female and one or two well grown young.

The female, when about to give birth, seems always to live quite alone in her own burrow—which may be half a mile or more from any other.

The burrow is dug in soft sandy soil—often in silt which has been washed down and has collected in some hollow or at the foot of a hill. It is practically always right out in the open, quite away from cover of any description—though should there be an ant-hill within twenty or thirty feet, it is a distinct advantage. It is dug some nine inches or so below the ground—rarely descending more than a foot—and is usually quite a simple burrow with two entrances, or exits, and the breeding chamber in the middle; but, it *invariably* has a bolt hole with a

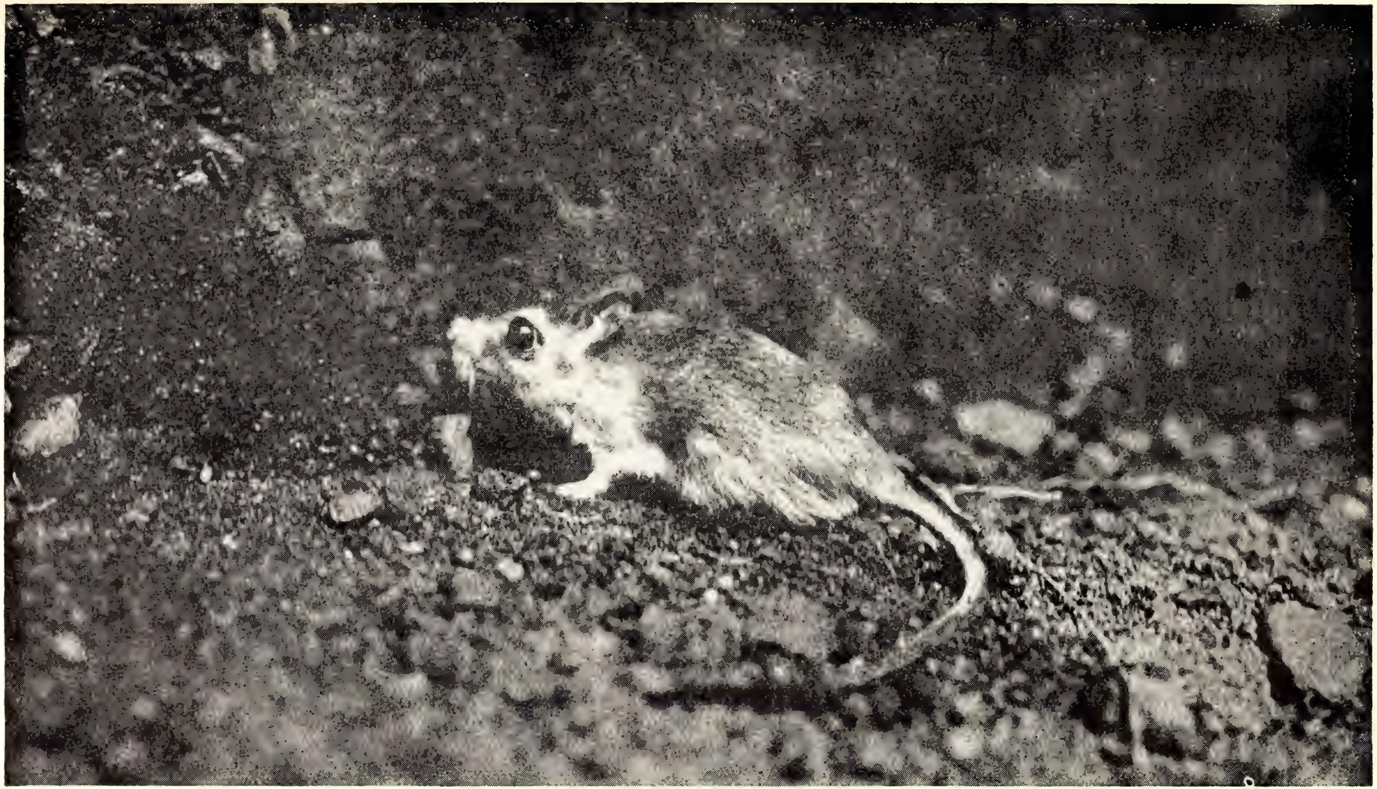
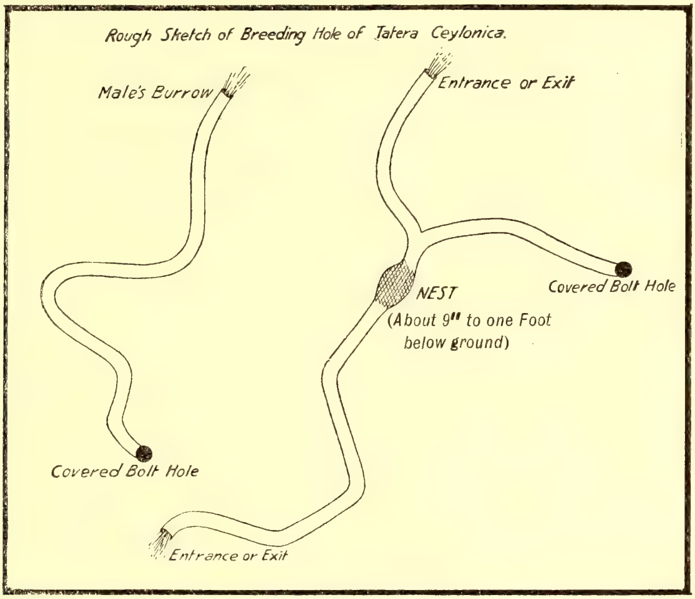


Photo by W. W. A. Phillips.

A YOUNG CEYLON GERBILLE (*Tatera ceylonica*).

concealed exit. This is a side gallery, leading off the main drive somewhere near the breeding chamber and is dug to within half an inch of the surface, a very thin hard crust being left.

If in danger, such as when being dug out, the animal will burst suddenly through this crust and bound off towards the ant hill or any other cover that may happen to be near at hand, trusting to the suddeness and the unexpectedness of its appearance, to make good its escape, which it usually does. If, however, the hole has previously been discovered by poking about with a stick, the gerbil may be easily captured alive, by placing a handkerchief or cloth of some description over the exit—into which it will rush headlong. The male's burrow may have only one entrance but *always* has the closed bolt-hole.


Rough Sketch of Breeding Hole of Tatera Ceylonica.
Male's Burrow
Entrance or Exit
NEST
(About 9" to one Foot below ground)
Covered Bolt Hole
Covered Bolt Hole
Entrance or Exit

The nest in the breeding chamber is a simple ball of dead and dry leaves, with no lining—in which the young remain until well grown. Four young are produced at a birth—sometimes only three or two; but I have never found more than four. They are born naked, blind and helpless and do not open their eyes until fully furred and fairly well grown—probably about a month old.

There seems to be no particular breeding season as the young may be found at any time throughout the year.

Owing to its nocturnal propensities it has been necessary to keep one or two in captivity in order to observe their habits. If taken young enough they will become perfectly tame and give little trouble, as they will not attempt to gnaw through a wooden box. By day they spend most of their time sleeping, either lying on the side half curled up or sprawling on the flat of the back with their feet in the air.

They thrive well on bread and milk but eat, with avidity, practically anything that is given to them. They are particularly fond of raw meat and insect food, devouring cockroaches and beetles with relish, and are also very partial to bird's eggs, either fresh or in an advanced state of incubation.

They will also kill and eat any small mammal that they can overpower—though they are not pugnacious among themselves. A young rat, put into the same cage, was immediately killed and eaten ; while a small bat (*Hipposideros atratus*) which was put in for a few moments was jumped upon as soon as it clung to the roof of the cage, and killed instantly with a bite into the brain.

I doubt however if, in the wild state, they would have much opportunity of killing other mammals.

In their burrows I have frequently come across small collections of rubber seeds and I fancy that those—together with insects—form the chief food of those that are found on the rubber estates.

Their chief enemy is man—for the Tamil cooly considers them to be excellent as food and makes a point of digging up any burrows he comes across. The flesh certainly looks as if it should be good eating—it is very white and clean looking.

DEER HUNTING IN SHAKESPEARE'S DAY

BY

Lt.-Col. C. E. Luard, C.I.E., I.A.

One of the great characteristics of Shakespeare is that he was a true sportsman, a genuine lover of field sports with an intimate knowledge that keeps turning up at every page of his works. This is well put forward in "The Diary of Master William Silence" by D. H. Madden, on which this note is based. The passages should be looked out and read with their context.

Deer hunting with hounds.

In those days (XVIth. century) no one could enclose a deer park except under royal license. Red and fallow deer were usually parked separately.

The hunt began with the "assembly", an out of doors dinner, which took the place of our "meet." Thus was inaugurated a "solemn hunting" (Tit. An., II-i-112). A clue to many of the terms used in the plays is given in a book published in 1575 called "The Noble Arte" (referred to here as "N. A."). While all were at the "assembly" the Chief Forester came up and presented his master with the "fewmets", or excrement of the stag, and other signs which gave a clue to his size. ("The stag's tail is called the 'single'; his excrements the 'fumets'—Goldsmith, 'Natural History'"). The forester has to rise betimes in the morning (1 Hen. IV., I-ii-29) just as much as a highway robber. The Forester, having marked down the stag or "hart," assisted the huntsman to "harbour" him, that is find out exactly where he was "lodged." Hence Theseus's order (M.N.D., IV-i-109) to his man.

And here let me digress a moment. In reading Shakespeare always remember that the people who live in his plays are all Englishmen. That is to say they have the characteristics of Englishmen whether Shakespeare has called them Petruchio, Iago, or Othello, and placed them in Bohemia or Venice. If you do not recollect this you lose much of the inner value of the plays.

The forester and huntsman go off to arrange the chase of the hart. A red deer was called generally a hart or stag and the female a hind, but the real woodcraft terms are, a Hinde or Hinde-calf. the first year; a Broket the second; a Spayad in the third; a Staggard in the fourth; a Stag in the fifth, and a Hart in the sixth (J. C., III-i-207). But "if the king or queen doe hunt or chase him and he escapes away alive, then after such a hunting or chasing he is called 'Hart Royal'" (Manwood—"Forest Lawes," 1598). The royal hart was then proclaimed as such and ever after roamed free (A and C., V-ii-337 "being royal took her own way"). A stag acquired his rights of brow, bay and trey antlers, and two points on the top of each horn at six years. The modern use of "royal," merely to distinguish such a stag is really a misuse. Manwood (loc: cit:) divides beasts of the chase into, hind, hare, boar and wolf, as beasts of the forest, and buck, doe, fox, marten and roe, as beasts of the field (See Psalms: 104, v. 20, beasts of the forest, and 50, v. 11, of the field).

Shakespeare was accustomed to rise early for his field sports and is always noticing sunrise (M. N. D., III-ii-389; R. & J., III-v-7; Ham., I-i-166; Sonnet xxxiii).

The huntsman in accompanying the forester brings his "lym" or liam-hound with him. He was a bloodhound held on a liam or leash (Lat.: ligamen), who smelt out the deer's trail, and was also, in consequence called the slot-hound (Scotch, sleuth-hound) as he followed the slot or foot-prints of the deer. (K.L., III-vi-72). They passed across the deer's trail which the dog at once picked up (Ham., II-ii-47, IV-v-109; M. W. W., IV-ii-212), having the hart "in the wind" (Alls Well, III-vi-123). So they reach the "entry" or break in the thicket

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Note.—References are to the "Oxford Shakespeare."

which the hart went through. Some branches are broken off to "blemish" or mark the spot, while the huntsman beats round the spot in "ring-walks" or circuits. The hart is found still "lodged" (T. G. of V., III-i-140) or lying up there, while a foot-print shews it is the same hart of "mettle" due to good pasturage (Hen. V., III-i-26) for "harts bear their heads according to the pasture and feede" (N. A.). The hart being thus found or "harboured" was next "unharboured," and being driven out was forced by "toils" or nets, (L.L.L., IV-iii-2; J. C., II-i-206; Ham., 888-ii-368; A. & C., V-ii-3) into the enclosed park or "pale" (1 Hen. VI., IV-ii-45) whence escape was impossible. When no pale was used it was called "hunting at force" (Markham "Cavalarice"). The hart, it must be recollected, was hunted to be killed and eaten, as also were hares, etc., similarly hunted into nets (M. of V., I--ii-22), not merely for sport of chasing them (see "Quarterly Review," Jan. 1895, "Our Sporting Ancestors") The hounds used were carefully bred, and had varying qualities of cry (M. N. D., IV-i-118—133). The terms "harbour" and "unharbour" are not used in this sense by Shakespeare. This term, moreover, is restricted to deer for "we lodge and rouse a buck, we form and start a hare, we burrow and bolt a coney: we kennell and un-kennell a fox". Rouse was also used generally (1 Hen. IV., I-iii-198) (for these terms see R. II., II-iii-128; Cor., IV-v-227; T. N., IV-i-63; M.W.W., III-iii-174 ; Ham., III-ii-86). Small bodies of hounds were sometimes posted on the probable path of the hart to pick up the chase before the main pack came up, it was called a "vaunt (*i.e.*, avant) laye."

The hart had thus been "singled" out by the liam hound (T. A., II-i-117 ; 3 Hen. VI., II-iv-12 ; L.L.L., V-i-86; V. & A., 693) and then "unharboured." As he came out the "prickers" or mounted huntsmen closed up all but one line ; the hart has them in the wind (Alls Well, III-vi-123), but the pricker must, if his winding them is not enough to turn him ride and "blench" him, *i.e.*, make him turn so as to go into the toils and so within the pale S. does not use "blench" except for to start aside (M. for M., IV-v-5, W. T., I-ii-333 ; Ham., II-ii-634 ; T. & C. I-i-30. It comes from "blanch" to frighten, make white with fear) As the hart comes out he for a moment "stands at gaze" (Luc., 1149) and then bounds off while all cry out "the game is up," the "tally-ho" of those days (R. & J., III-v-26; Cym., III-iii-107; T. A., II-ii-1). So he makes off in full view and not like a fox "in stealth" (K. L., III-iv-93). The master, as now-a-days would rebuke the too eager rider (Cor : III-i-273). An old hart often refused to break thicket (T. & C., II-ii-27, c.f., 3 Hen., VI., III-i-8, 3, & IV-v-2) driving out a younger hart, if present, to save his own skin. The hounds had to run compactly together, if a hound overran or "overtopped" the rest he was "trashed"; that is a heavy collar or else a long strap was put on to him which impeded his movements (Temp., I-ii-81 ; Hen. VIII., I-i-141 ; 0th., II-i-315, a play on the word here).

"Bawlers" and "Babblers" were also dealt with, the first being hounds who cry too much before a scent is established, the other after it is found, the former is the worst (Hen. V., II-iv-70; T. & C., V-i-101 also Temp., I-i-45, and 48, "bawling" and "hang cur" being thus connected). Master Ford was a "bawler" (M.W.W., III-iii-173 and IV-ii-208). The hounds of those days were not fast but "slow in pursuit" (M.N.D., IV-i-12). A hart's scent is much stronger than a fox's or a hare's and hence the hound runs in comparative silence being fully occupied, and not as in the case of the other two animals where a "cold fault" (V.& A., 694) or cold scent (T.N., II-v-136) leads to competition to retrace the lost line during a "let" or check (Oth., III-ii-371, Two Noble kinsmen, III-v-156). A fox's scent is called "rank." At a "let" or, as we say, check the huntsman blew a "jeopard" (Fr : j'ai perdu). Other calls were, the "recheat" (M.A.N., I-i-251) or calling off the hounds (Fr. Racheter); the "seeke" or setting on (Tem. Stage direction, IV-i-258) and the "fall" or "mort," the death blast W. T., I-i-119). These are given in the "Noble Arte" thus, *Wofull wordes of the Hart to the Hunter.*

So now he blowes his horne, even at the kennell dore,
Alas, alas, he blowes a seeke, alas yet blowes he more;
He jeopardes and rechates; alas he blowes the fall,
And soundes that deadly mote (mort), which I must die with all.

A hound going off on a false trail was said to run-counter and if addicted to it was hanged (2 Hen. IV., I-ii-102 ; Ham., IV-v-106 ; C. of E., IV-ii-39) Hounds were cheered on by name as now (Tem., V-i-261 ; M.W.W., II-i-120 ; T. N., II-v-137 ; 1 Hen. IV, III-i-239 ; K. L, I-iv-125 ; T. of S, Intro : I-17-26 ; T & C, V-i-102). The names are interesting as Beckford (Thoughts on Hunting) gives Fury, Tyrant, Ringwood, Merryman, Belman, Echo, Mounter and Saunter. Probably Mountain and Sowter are miscopyings for Mounter and Saunter, as otherwise they have no meaning. A " brach " (K. L., III-vi-72), originally applied to all hounds hunting by scent, was then used only for a hound-bitch (Fr : brac, braque. Sp : braco, a pointer). Hence clearly some misreading has crept into brach Merriman (T.S. Intro. I-18).

A hound on a good scent was said to be "full of vent " (Cor., IV-v-239, see Baynes, Edin. Rev., Oct. 1872) that is had the hart well winded. Dr. Johnson and Pope misunderstood the term. A hound is said to strain upon good vent (N. A.). Vent is equivalent to wind used often for scent (T. A., IV-i-97 ; ii-134 ; Alls Well, III-vi-122; V-ii-19 ; 3 Hen.VI., III-ii-14 ; Ham. III-ii-362). Spenser says a Bullock " venteth into the wind " and explains in his glossary that it means " snuffeth into the winde ". A reliable straight running hound is " true bred " and can " hold in " and " n'ere will out " (T.N., II-iii-198; 1 Hen. IV., II-i-85; A. and C., II-vii-36 ; K. J., I-i-223 ; Cor. I-vi-19 ; Luc. 1936. Son. lxiii ; 2 Hen. IV, V-iii-67). The hart hard pressed " strains " to escape (W. T., III-ii-46) and Johnson's emendation " have been stained " is not correct. Finally the hart becomes " embossed " or foamy at the mouth (N. A.) and tired out (T. S. Intro., I-18 ; 1 Hen. IV., III-iii-176). Chaucer used this word in three ways, *viz.*, to hide or take ambush " the hert upon lengthe so much embossed" (Dethe Blanch), stuck up, in relief or swollen, " of golde the barris up embossed" (" embossed rascal " of Falstaff), and as above. The hart's " fall " is near (Alls Well, III-vi-107). He turns at length to face the hounds being " an English deer ", one " in blood " full of mettle, and no "rascal" (1 Hen. VI., IV-ii-48 ; Ham., II-ii-501) A " rascal " was a worthless deer, lean and ill favoured (2 Hen., IV-iv-33; 1 Hen. VI., V-ii-35 ; Cor., I-i-165 ; L. L. IV-ii-3 ; 1 Hen. VI, II-iv-48). The hart was now " bayed " M.N.D., (IV-i-119; 1 Hen. IV., IV-ii-48; V. and A., 877; J.C., III-i-204 ; Ric. II-iii-128). The hounds are gathered in one place which echoes to the cry of the hounds (T. of S., Int, II-16; T. A., II-iii-17; V. and A.,885). Hounds were injured in this stand of the deer (V. and A., 695, 885, 913, 915). The huntsman puts a rope on the hart's horns and cuts its throat, while the "mort" is blown (W.T., I-i-119). The principal gentleman or lady present then " assayes " the deer making a cut along the brisket to see if the meat is good. The specially prized parts were then cut off and put aside. These " deintie morsels " were the caule, long, ears, doulcets (Two N. Kinsmen, III-v-154) tenderlings, seet-gut or Inche pinne, and the mumbles or umbles, to make umble-pie. The hounds were then different from quarry-game rewarded with the "quarry" (Fr. Curee), and novices were " blooded " with the " lethe " of the deer (T.N., III-iv-245 ; K.L., II-i-321 J.C. III-i-204, 206) or blood shed at its " fall ". The venison was sent to the " powdering " tub to be seasoned down (1 Hen. IV., V-iv-102) the skin was the keeper's fee (3 Hen. VI., III-i-22). Wounded and tired hounds were cared for (V. and A., 915 ; T. of S., Int : I-17).

These hounds were closer to bloodhounds than the modern hound (M.N.D ; IV-i-126). Three classes were recognized, the liam, beagles (T. N., II-iii-198), and running hounds for the chase of buck, stag, roe, fox (V.A. 673). The fox was looked on then as vermin to be exterminated in any way (Alls Well, III-vi-110

M.W.W., III-iii-172; 2 Hen., VI, VI-i-254; Cym.,III-iii-40; K.L, III-iv-96, V-iii-22.

The fox's skin was called his "case" (Alls Well, III-vi-110; T.N. V-i-167).

Deer stealing was held a venial offence, the dodging of a warrener fair sport (T.A., II-i-93; M.W.W., I-iii-28) Gilbert White mentions that it was but just extinct in his day (Nat: His: of Selborne).

Deer shooting.—This was practised, the animals being driven past "stands" (Cym., III-iv-111; M.W.W., V-vi-260; M. for M., IV-vi-10). These were usually thickets (3 Hen, VI, III-i-1; ibid, IV-v-3; M for M, I-iii-41) which commanded the drives or "launds" (c.f lawn)" 3 Hen. VI.,-III-i-2; and of Temp., IV-i-130; L.L.L., IV-i-7; V-ii-310). He who handled his cross-bow like a woodman and not like a "crowkeeper" (K.L., IV-vi-87) would shew up best and be accounted "lord of the feast" which followed (Cym., III-iii-74; III-vi-28) and at it was served by the others. The deer were driven in front of these stands, or "stalled" (Pas. Pil., xix) by "dryvars."

> The dryvars thorowe the woodes went
> For to reas the dear
> (*Ballad of Percie and Douglas*)

Such deer were seasonable (Luc., 580; M.W.W., III-iii-168; T.A., II-i-117). The expert forester marks these, as mere size of antlers was no test and you may get a rascal (As You L. I., III-iii-60) and the forleader of a herd may be a rascal (Cor, I-i-165). The deer must not be wounded but struck home (L.L.L., IV-i-24; Ham., III-ii-282; T.A., III-i-88). In case of a wounded deer, however, greyhounds were kept ready to be loosed to pull it down (T. of S., Int: II-50), but deer so retrieved were held "ill-killed" (M.W.W., I-i-80; As Y. L.I, II-i-31). Foresters were not above taking "tips" for giving a good "stand" (L.L.L., IV-i-8-19; Cym., II-iii-73). Buck were distinguished as, fawn the first year, (T. & C., III-iii-26), pricket the second (L.L.L., IV-ii-2) sorel the third (L.L.L., IV-ii-58) sore the fourth, buck of the first head the fifth, and great buck, the sixth. One sent venison, stollen or otherwise, to gain favour as we see from the "bribebuck" (M.W.W., V-v-27).

The deer shot were collected in the "quarry" (Fr. Carre) which is different to the similar word mentioned above.

> Lord Percie to the quarry went
> To view the slaughtered deer

It then came to be applied to a heap of deer's bodies (Ham., V-ii-378) and finally to the animal chased.

This note, like that on hawking, was originally written for a schoolboy, but if it leads to greater familiarity with Mr. Madden's book it will have achieved more than it set out to do.

BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA, BURMA AND CEYLON.

REPORT NO. 36, NAGA HILLS.

BY J. P. MILLS, I.C.S.

The specimens included in this collection were all obtained in the Mokokchung Sub-division of the Naga Hills, a mass of mountains lying to the South-east of the Brahmaputra River and forming the watershed between Assam and Burma. The position of the area where the collection was made is about 26°15 N., 95°25 S. E. The country in question is inhabited by Nagas, who live in fixed villages, but practise the shifting method of cultivation known as "jhuming." For cultivation of this type the jungle is cut and burnt, and the land sown for two years. It is then abandoned for ten or fifteen years, and the process repeated. Jungle grows quickly in such a damp climate—the rainfall is about 120 inches a year—and abandoned fields are soon covered with a very dense secondary growth of grass, bushes and small trees, interspersed with a few large trees which were only lopped at the time of cultivation and have recovered.

The population is as dense as the land can support by this method of cultivation, and primeval jungle only exists on slopes which are too steep or rocky for cultivation and in the valleys where it is impossible to protect the crops against elephants. This primeval jungle consists of huge trees, many of them berry-bearing. The ground under them is mostly in heavy shade and is usually lightly covered with straggly bushes.

Most of the specimens were taken at a height of between four and five thousand feet in a piece of primeval jungle near Mokokchung, the Sub-divisional Headquarters. The method employed was to set a line of traps near the edge of the jungle to catch mammals going to and fro at night between the primeval jungle and the heavy secondary growth of the temporarily abandoned fields which lay immediately below it.

The collection contains 123 specimens distributed among 39 genera and 49 species, of which a detailed list is given below.

(1) HYLOBATES HOOLOCK, Harl.

The Hoolock.

(Synonymy in No. 14.)

Mokokchung, 5,000′, ♂ 1, ♀ 2.

Very plentiful and tame where not persecuted. Apparently never descends to the ground. Individuals caught in a fire will remain and be burnt sooner than come down and cross open fields to the next patch of jungle.

(2) Macaca assamensis, McCl.

The Himalayan Monkey.

(Synonymy in No. 16.)

Mokokchung, 5,000′, ♂ 3, ♀ 3.

Common in the jungle but rarely approaches villages.

(3) Macaca mulatta, Zimm.

The Indian Macaque.

(Synonymy in No. 7.)

Chuntia, 4,000′, ♂ 1, ♀ 1.

Swarms round villages of the Ao Nagas who do not eat them. A bold and clever thief.

(4) Macaca arctoides, Geoff.

The Stump-tailed Macaque.

1833. *Macacus arctoides*, Geoffroy, Mag. Zool. Cl. 1, pl. II.
Merangkong, ♀ 1; Dikhu River, ♂ 1, ♀ 1.

Found in troops which may number forty individuals or more. Generally keeps to the ground. Troops are often surrounded by Nagas and wiped out. Are very partial to fresh-water crabs, for which they search the beds of mountain streams.

(5) Pithecus pileatus pileatus, Blyth.

The Capped Langur.

(Synonymy in No. 20.)

Mokokchung, 5,000′, ♂ 1, ♀ 1; Cholimsen, ♂ 1.

Chiefly found at fairly high elevations.

(6) Pithecus pileatus saturatus, Hint. subsp. n.

The Capped Langur.

1921. *Pithecus pileatus saturatus*, Hinton, J.B.N.H.S., Vol. XXIX, p. 81 Lakhuti, ♂ 1.

The commonest of the two subspecies and does not herd or interbreed with the other subspecies. Found at low elevations.

(7) Nycticebus coucang, Bodd.

The Slow Loris.

(Synonymy in No. 17.)

Naga Hills, ? 1.

Very rare. Lhota Nagas hold the animal in horror and believe that the appearance of one forebodes a drought.

(8) RHINOLOPHUS FERRUM-EQUINUM TRAGATUS, Hodgs.

Hodgson's Horse-shoe Bat.

1835. *Rhinolophus tragatus*, Hodgson, J.A.S.B., IV, p. 699.
1888. *Rhinolophus ferrum-equinum*, Blanford, No. 156.
Aichisagami, ♂ 2, ♀ 1.

Common in places. Aichisagami bungalow swarms with them.

(9) NYCTALUS LABIATUS, Hodgs.

The Indian Noctule Bat.

(Synonymy in No. 25.)

Mokokchung, 4,500′, ♂ 1.

(10) PIPISTRELLUS MIMUS, Wrought.

The Southern Dwarf Pipistrel.

(Synonymy in No. 1.)

Mokokchung, 4,500′, ♂ 3.

(11) TUPAIA BALANGERI ASSAMENSIS, Wrought.

The Assam Tree Shrew

1921. *Tupaia belangeri assamensis,* Wroughton, J.B.N.H.S. Vol. XXVII, No. 3, p. 599.

Mokokchung, 5,000′, ♂ 4, ♀ 4.

(12) PARASCAPTOR LEUCURUS, Blyth.

The White-tailed Mole.

1850. *Parascaptor leucura,* Blyth. J.A.S.B. XIX., p. 215.
1888. *Talpa leucura,* Blanford Mammalia No. 113.
Mokokchung, 4,500′, ♀ 1.

Some Nagas believe it to be very unlucky to see, leave alone touch one. They regard it as the dead man's deer, which only comes through to the surface of the earth when hard pressed by hounds in the underworld.

(13) CHIMMAROGALE HIMALAYICA, Gray.

The Himalayan Water Shrew.

(Synonymy in No. 23.)

Pangti, 2,000′, ♀ 1.

Apparently an albino.

(14) FELIS BENGALENSIS, Kerr.

The Leopard Cat.

(Synonymy in No. 11.)

Mokokchung, 4,500′, ♂ 1.

Very plentiful and destructive to poultry.

(15) VIVERRA ZIBETHA, L.

The Large Indian Civet.

(Synonymy in No. 14).

Okotso, ♂ 2.

(16) VIVERRICULA MALACCENSIS, Gmel.

The Small Indian Civet.

(Synonymy in No. 3.)

Sangrachu, 3,500′, ♂ 2.

Plentiful, but exceedingly difficult to trap.

(17) PAGUMA GRAYI, Benn.

The Himalayan Palm Civet.

(Synonymy in No. 15.)

Mokokchung, 4,500′, ♂ 1.

(18) ARCTOGALIDIA MILLSI, Wrought. sp. n.

The Naga Palm Civet.

1921. *Arctogalidia millsi*, Wroughton, J.B.N.H.S., Vol. XXVII No. 3, p. 600.

Mokokchung, 5,000′, ♂ 1.

Very rare indeed. This specimen was shot at dusk while climbing about in a tree in virgin forest. The Nagas had no name for the animal.

" So far as I have been able to find out, there is no reliable record of an *Arctogalidia* nearer than Sylhet, more than 150 miles away, and this one seems to be very much bigger, if not half as large again, so that Mr. Mills' discovery is of great interest."—R. C. W.

(19) HERPESTES NEPALENSIS, Gray.

The Small Assam Mongoose.

1837. *Herpestes nepalensis*, Gray, Ch. Mag. N. H. I, p. 578.

Mokokchung, 4,000′, ♂ 1.

Not common.

(20) ARCTONYX COLLARIS, F. Cuv.

The Hog Badger.

(Synonymy in No. 25.)

Longpa, ♂ 1.

Very uncommon.

(21) AMBLONYX CINEREA, Illing.

The Claw-less Otter.

(Synonymy in No. 11.)

Dikhu River, ♂ 1.

Common. Eaten by some Nagas, who believe that by doing so they will prevent fish bones sticking in their throats.

(22) URSUS TORQUATUS, Wagn.

The Himalayan Black Bear.

(Synonymy in No. 25.)

Okotso, 3,500′, ♂ 1, ♀ 1 ; Are, 3,000′, ♂ 1, ♀ 1. Skulls only.

Nagas divide the bears of this region into three distinct species There is not yet sufficient material to determine this point definitely.

(23) MUSTELA KATHIAH, Hodgs.

The Yellow-bellied Weasel.

(Synonymy in No. 15.)

Sangrachu, 3,500′, ♀ 1.

Apparently not at all common.

(24) CHARRONIA FLAVIGULA, Bodd.

The Northern Indian Marten.

(Synonymy in No. 15.)

Sangrachu, 3,500′, ♂ 1 ; Mokokchung, 4,500′, ♂ 1.

Plentiful. Usually found in twos or threes. Is reported to visit Ao Naga cemeteries and eat the corpses exposed on platforms.

(25) HELICTIS MILLSI, Thos.

The Naga Ferret Badger.

1921. *Helictis millsi,* O. Thomas, J.B.N.H.S., Vol. XXVIII, No. 2, p. 432.

Mokokchung, 5,000′, ♂ 3, ♀ 1.

Mr. Thomas has dealt with this species under "Results." All the specimens obtained were trapped in virgin forest. The Nagas regard the animal as rare and local.

(26) CUON DUKHUNENSIS, Sykes.

The Indian Wild Dog.

(Synonymy in No. 2.)

Akuk, 3,500′, ♂ 1; Mokokchung, 5,000′, ♂ 1.

The Nagas recognise two species of wild dog—the ordinary red one which hunts in packs, and another longer-legged animal which is larger, fiercer and runs in pairs or threes at most.

(27) Petaurista yunnanensis, And.

Anderson's Flying-Squirrel.

1875. *Pteromys yunnanensis,* Anderson, A.M.N.H. (4), XVI, p. 282
1888. ,, ,, Blanford Mamm. No. 230.
Mokokchung, 5,000′, ♂ 1, ♀ 1; Longpa, ♀ 1.

(28) Hylopetes alboniger, Hodgs.

The Parti-coloured Flying-Squirrel.

(Synonymy in No. 20.)

Mokokchung, 5,000′, ♂ 1, ♀ 2.

29) Ratufa gigantea, McCl.

The Assam Giant Squirrel.

(Synonymy in No. 14.)

Lakhuti, 1.500′, ♀ 1, Mokokchung, 5,000′, ♂ 2.
Plentiful.

(30) Callosciurus erythræus nagarum, Thos. and Wrought.

The Naga Squirrel.

(Synonymy in No. 20.)

Mokokchung, 5,000′, ♂ 1, ♀ 1; Cholimsen, 4,000′, ♂ 1, ♀ 1.
Sangrachu, 3,000′, ♂ 1; Wokha, 5,000′, ♂ 1.
Manipur, Upper Assam, ♀ 1.

(31) Tomeutes blythi, Tytler.

Blyth's Squirrel.

854. *Sciurus blythii,* Tytler. Ann. N.H. XIV, p. 172.
Sangrachu, 3,000′, ♂ 1, ♀ 1; Mokokchung, 5,000′, ♀ 1

(32) Dremomys lokriah, Hodgs.

The Orange—bellied Himalayan Squirrel.

(Synonymy in No. 20.)

Wokha, 5,000′, ♂ 1.

(33) Dremomys rufigenis opimus, Thos.

The Northern Red-cheeked Squirrel.

(Synonymy in No. 20.)

Mokokchung, 5,000′, ♂ 2, ♀ 3.

(34) Dremomys pernyi, M. Edws.

Perny's Dremomys.

(Synonymy in No. 25.)

Mokokchung, 5,000′, ♂ 1.

(35) DREMOMYS MACMILLANI, Thos. & Wrought.

The Striped Dremomys.

(Synonymy in No. 20.)

Mokokchung, 5,000′, ♂ 1, ♀ 2.

(36) TAMIOPS MACLELLANDI MANIPURENSIS, Bonh.

The Manipur Striped Squirrel.

(Synonymy in No. 20.)

Mokokchung, 5,000′, ♂ 2.

(37) LEGGADA, sp.

Mokokchung, 5,000′, ♂ 1.

(38) RATTUS RATTUS SIKKIMENSIS, Hint.

The Darjiling Tree Rat.

1918. *Rattus rattus sikkimensis,* Hinton, J.B.N.H.S., XXVI, p. 61.
Mokokchung, 5,000′, ♂ 1, ♀ 1.

(39) RATTUS RATTUS TISTAE, Hint.

The Himalayan Tree Rat.

1918. *Rattus rattus tistæ,* Hinton. J. B. N. H. S., XXIV, p. 61,
Mokokchung, 5,000′, ♂ 1.

(40) RATTUS FULVESCENS, Gray.

The Chesnut Rat.

(Synonymy in No. 15.)

Mokokchung, 5,000′, ♂ 4. (1 Flat skin).

(41) RATTUS MENTOSUS, Thos.

The Chin Rat.

(Synonymy in No. 25.)

Mokokchung, 5,000′, ♂ 2.

(42) RATTUS EDWARDSI, Thos.

The Fokien Rat.

1882. *Rattus edwardsi,* Thomas. P.Z.S., p. 527.
Mokokchung, 5,000′, ♂ 1, ♀ 2.

(43) RATTUS BOWERSI, And.

Anderson's Rat.

(Synonymy in No. 16.)

Mokokchung, 5,000′, ♂ 1, ♀ 2.

" The first three of these six forms have their type locality in Nepal and Sikkim, while the last three, are, or rather hitherto have been found only much more to the east".—R.C.W.

(44) RATTUS MANIPULUS, Thos.

The Manipur Rat.

(Synonymy in No. 25).

Mokokchung, 5,000′, ♂ 1.

(45) ACANTHION BENGALENSIS, Blyth.

The Bengal Porcupine.

1851. *Hystrix bengalensis,* Blyth. J.A.S.B. XX, p. 170.
Longpa, ♀ 1.

(46) ACANTHION MILLSI, Thos.

Mills' Porcupine.

1922. *Acanthion millsi,* Thomas, J.B.N.H.S., Vol. XXVIII, No. 2, p. 431.
Mokokchung, a skull only.

The only specimen I have seen is a dead one which I found in an old game pit in virgin jungle.

(47) RHIZOMYS PRUINOSUS, Blyth.

The Hoary Bamboo Rat.

1851. *Rhizomys pruinosus,* Blyth. J.A.S.B. XX., p. 519.
1891. „ „ Blanford Mamm No. 313.
Mokokchung, 5,000′, ♂ 1, ♀ 1.
Between Mongsemdi and Chantongia, ♀ 1.

(48) CANNOMYS BADIUS, Hodgs.

The Bay Bamboo Rat.

(Synonymy in No. 20.)

Mokokchung, 5,000′ ♂ 1, ♀ 2. (2 juv.)

(49) CAPRICORNIS SUMATRENSIS RUBIDUS, Blyth.

The Aracan Serow.

1863. *Capricornis rubida,* Blyth. Cat. Mamm. Mus. A.S.B., p 174.
1891. *Nemorhœdus sumatrensis,* Blanford Mamm. No. 353 partim.
Longpa, ♂ 1.

Usually found on suitable ground, *i.e.,* jungle-clad cliffs. Always to be found near certain warm mineral springs which it frequents. Occasionally found as low as 1,000′. Feeds only at night, retiring for the day to sleeping ledges on cliffs, from which it can see without being seen. An animal will use the same ledge till it thinks it has been discovered, when it will leave it at once. It always keeps to the same paths, a habit which makes it easy to trap.

(50) MUNTLACUS VAGINALIS, Bodd.

The Bengal Rib-faced Deer.

(For synonymy, see Nos. 2 and 20.)

Mokokchung, 5,000', ♂ 1; Mongsemdi, ♀ 1.

Where it is not persecuted it is far commoner near villages than in more remote jungle. Likes heavy cover and is consequently rarish in virgin jungle, where the undergrowth is sparse. When hunted it will run in circles, using the same path time after time.

(51) MANIS PENTADACTYLA, L.

The Eastern Pangolin.

1766. *Manis pentadactyla,* Linnæus. Syst. Nat., p. 52.

Khensa, ♀ 1.

Not very common. Can burrow with amazing speed. Chang Nagas will only eat one if they can kill it before it has curled up sufficiently for its tongue to reach its genital organs. Otherwise the meat will be 'bitter.'

THE IDENTIFICATION OF INDIAN BUTTERFLIES.

By Lieut.-Col. W. H. Evans, D.S.O., R.E., F.Z.S., F.E.S.

(*Continued from page* 747 *of Volume XXVIII, No.* 3).

(*With nine black and white plates*).

A. Papilionidæ.—The Swallowtails. Genera Key.

1a (12a). F v9 present. H with precostal cell.

1b (10a). F v9 from about upper end of cell. F spur near base from mv towards v1.

1c (9). Palpi short, pressed against face.

1d (8). F v9 strongly bowed down at origin, not near or parallel to v10.

1e (3a). H v8 short, not nearly as long as v1 F. Larva on Aristolochia and is covered with many large hairy tubercles. Thorax below red.

1 (2). F v11 long, from opposite the origin of v2. Large, heavy body, mostly yellow. Head black with narrow red collar. H more or less shining yellow ♂ with anal valves and scent organ H well developed.

Troides, Hub.—The Birdwings. (Plate 1).

2 (1). F v11 from opposite the origin of v3. Head red.

Byasa, M.—The Red-bodied Swallowtails. (Plate 1).

3a (1e). H v8 as long as v1 F. Larva never on Aristolochia. Except for A4/4 head and body never red.

3b (5a). F v11 free from v12. ♂ no scent organ; anal valves prominent.

3 (4). Larva with many spiny tubercles; pupa stick like. H v7 either very near v8 or v6, F v2 bowed. Tailless. Head white spotted; abdomen below black and white spotted.

Chilasa, M.—The Mimes. (Plates 1 and 2).

4 (3). Larva practically smooth. H v7 about midway between v8 and v6; dcv 7-6 straight or nearly so. F v2 rarely bowed.

Papilio, L.—The Black-bodied Swallowtails. (Plates 2-5).

5a (3b). F v11 anastomosed to v12. ♂ anal valves prominent and scent organ usually present. Antennæ scaled above. Pupa four-sided; larva smooth. Abdomen black striped below.

5b (7). H tailed or produced; v7 midway between v8 and v6.

5 (6). H tail long, slender, white edged. Above mostly white or pale greenish, with black stripes F.

Pathysa, M.—The Swordtails. (Plate 5).

6 (5). H tail short, stout and black or absent. Apex F and tornus H much produced. Mostly black with green bands and spots.

Zetides, M.—The Bluebottles and Jays. (Plate 5).

7 (5b). H. rounded, tailless; v7 much nearer v8 than v6.

Paranticopsis, DeN.—The Zebras. (Plate 6).

8 (1d). F v9 straight at origin, close to and parallel to v10; v11 free. F highly falcate. Claw of tarsi with a tooth in or behind the middle. With scent organs and anal valves.

Meandrusa, M.—The Gorgons. (Plate 6).

9 (1c). Palpi long, porrect. F v6 much nearer v7 than v5. No scent organ or anal valves.

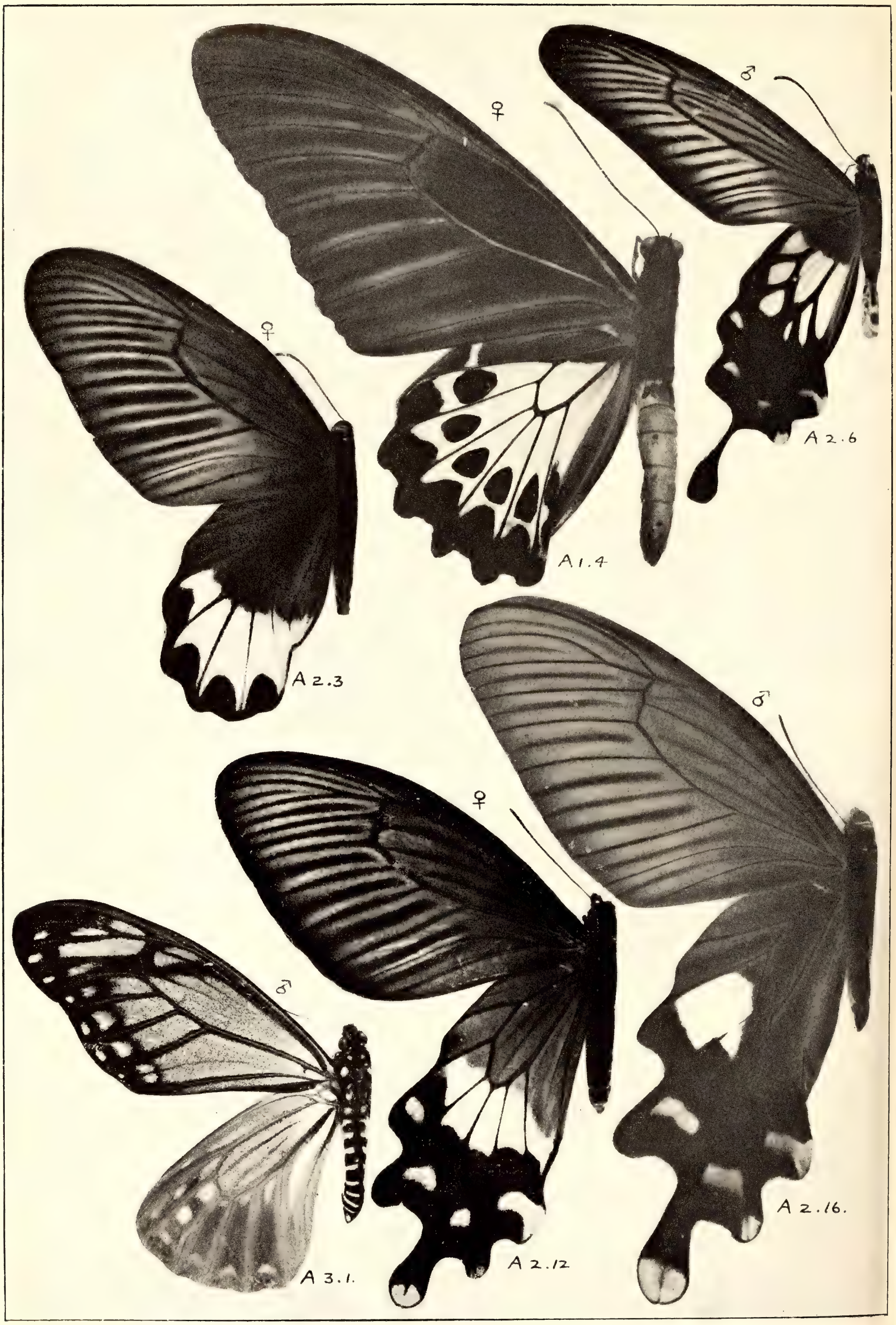
Teinopalpus, Hope.—The Kaiserihind. (Plate 6).

10a (1b). F v9 from well beyond end cell. No anal valves.

10 (11). F v9 out of v8, which meets v7 at end cell. H cell very small. Antennæ longer than cell. H produced to a long tail. F outer half clearwing.

Leptocircus, Swain.—The Dragontails. (Plate 6).

11 (10). F v9 and v8 out of v7; v6 and v7 approximate.


♀
♂
A 2.6
♀
A 1.4
A 2.3
♂
♀
♂
A 2.16.
A 3.1.
A 2.12

A. **Papilionidae.** 1. *Troides*: 2. *Byasa*: 3. *Chilasa*.

A. Papilionidiæ.—The Swallowtails. Genera Key—*contd.*

Armandia, Blanch.—The Bhutan Glory.

12 a (1a). F v9 absent; no spur from mv. H no precostal cell.

12 (13). H v8 shorter than v1 F. F v10 and 7 from a point. Antennæ club short, abrupt and flattened.

Hypermnestra, Men.—The Desert Apollos. (Plate 6).

13 (12). H v8 longer than v1 F. F v10 and 7 well separated at origin. Antennæ club gradually elongate and rounded. ♀ with horny pouch.

Parnassius, Lat.—The Snow Apollos. (Plate 6).

A1. Troides.—The Birdwings. (Plate 1).

1a (3a). H space 1 black. 1b (5). ♂ upf no yellow.

1 (2). H cell mostly black.

darsius, Gray. (140-160). The Ceylon Birdwing, Ceylon, C.

♂ v. *cambyses, Ehr.* With discal spots H. R.

2 (1). H cell mostly yellow.

minos, Cr. (140-190). The Malabar Birdwing, South India. NR.

3a (1a). H space 1 mostly yellow in ♂; ♀ at least a yellow spot in middle; cell mostly yellow.

3 (4). ♂ all space 7 H yellow; ♀ base space 1 black.

œacus, Fd. (150-170). The Golden Birdwing. Garhwal—Burma, NR.

4 (3). ♂ space 7 H black at base; ♀ base space 1 yellow. α. Larger and paler.

helena cerberus, Fd. (140-170). The Common Birdwing. Sikkim—Burma C.

*v. *eumagos, Jord.* Upf whiteish vein stripes absent. NR.

β. Smaller and darker.

helena heliconoides, M. (130-160). The Andaman Birdwing. Andamans, C.

♂ *v. aphnea, Jord.* Upf with whiteish vein stripes. R.

5 (1b). ♂ upf prominent yellow (♀ white) area about end cell.

amphrysus ruficollis, But. (130-160). The Malay Birdwing. Mergui. VR.

A2. Byasa.—The Red-bodied Swallowtails. (Plate 1).

1a (5a). Tailless. ♂ anal valves and scent organ prominent. No red markings. Abdomen below red, black banded (except No. 4).

1b (3a). Uph no pale area.

1 (2). ♂ uph dorsal fold rounded and lower half scent area white. Upf pale streaks visible in cell. ♀ above brown. Abdomen broad white stripe at side and head pinkish white.

aidoneus, Db. (100-120). The Lesser Batwing. Garhwal—Shan States. R.

2 (1). ♂ uph dorsal fold square and scent area only with a small white patch. ♀ shining black. Abdomen red stripe at side and head red.

α. ♂ unf no white stripes before margin. ♀ pale area near tornus upf and stripes dusted over and suffused.

varuna astorion, Wd .(90-130). The Common Batwing. Kumaon—Tavoy NR.

β. ♂ unf white stripes before margin. ♀ upf pale tornal area pure white and sharp defined.

varuna varuna, White. Mergui—S. Burma. R.

3a (1b). Uph outwardly with a pale area.

3 (4). Uph ♂ submarginal white patches space 2-4; ♀ large white discal area from dorsum to space 5.

**zaleucus, Hew.* (80-110). The Burmese Batwing. Shan States—S. Burma-NR

♂ *v. punctata, Evans.* White area black spotted. R.

4 (3). Uph outer half blue grey with black spots. Body yellow, black spotted. Head white. ♂ dorsal fold uph white, with red margin.

A2. Byasa.—The Red-bodied Swallowtails. (Plate 1)—*contd.*

sycorax, Gr. S. (110-130) The Whitehead Batwing. Mergui. VR.

5a (1a). Tailed.

5b (8a). Tail long, spatulate, with very narrow neck. ♂ anal valves prominent, open above; scent organ ill developed.

5c (7). Tail black.

5 (6). Uph no white spots; a rather pale red discal area from space 1-4. Head black; outer half abdomen all yellow.

neptunus, Guer. (100-120). The Yellow-bodied Clubtail. Tavoy—S. Burma. VR.

6 (5). Uph with white spots. Abdomen red and black; head red. F long and narrow. H outer half of cell white.

α. Uph white spots beyond cell extensive and complete.

coon cacharensis, But. (100-120). The Common Clubtail. Assam. NR.

β. Uph white spots more restricted.

**coon doubledayi, Wall.* Burma. C.

γ. Uph red spots near margin in space 3 united.

coon sambilanga, Doh. Nicobars. R.

7 (5c). Tail red. Uph no discal spots in 3, 4 or 7.

rhodifer, But. (120-140). Andamans. The Andaman Clubtail, NR.

8a (5b). Tail gradual, neck not narrow. Head and abdomen below mostly red.

8b (11a). ♂ no anal valves and scent organ ill developed. Unh complete row 7 red spots.

8 (9a). Uph outer half at least of cell white and complete row of large discal spots beyond.

α. Upf outer white area prominent; no black stripes in 2 and 3; pale stripes do not enter cell.

jophon jophon, Gray. (110-130). The Ceylon Rose. Ceylon. R.

β. Upf all black stripes complete and pale stripes enter cell.

jophon pandiyana, M. (100-130). The Malabar Rose. S. India. R.

9a (8). Uph at most a small white spot end cell.

9 (10). Uph discal and submarg row red spots. Upf prominent white central and apical band.

hector, L. (90-110). The Crimson Rose. Ceylon—Bengal. C.

10 (9) Uph white discal spots in 2-5, some of which may be absent.

α. Uph usually white spot end cell; discal spots prominent and pressed up against cell. Unh discal spot in 1 white.

aristolochiœ ceylonicus, M. (80-110.) The Common Rose. Ceylon, VC.

β. Uph rarely spot in cell; unh spot in one mostly red. Typical form with spots remote from cell and incomplete.

aristolochiœ aristolochiœ, F. India. VC.

v. *diphilus, Esp.* discal spots complete and against cell.

γ. Discal spots often red edged. Unh discal spot in 1 often red. Only *diphilus* form seems to occur.

aristolochiae goniopeltis, Roth. Burma. VC.

δ. Typical form with the discal spots reduced to 2 obscure ones in 1 and 2, *diphilus* form also occurs.

aristolochiœ camorta, M. Nicobars. VC.

11a (8b). ♂ with anal valves and scent organ well developed. Uph no white in cell.

11b (17a). Uph with discal white spot or spots.

11c (14a). Uph white discal spots 2-4 or 5 and submarginal spots 2-5.

11 (12a). Tail black. Uph submarginal spots in 4 and 5 white and that in 5 often joined to discal spot. Unh submarginal spot in 6.

adamsoni, Gr. S. (90-110). Adamson's rose. Shan States—Dawnas. R.

12a (11). Tail red tipped.

A2. Byasa.—The Red-bodied Swallowtails. (Plate 1)—*contd.*

12 (13). H cilia black from tornus to v3.

α. ♂ uph no discal spot in 5. ♂ spot in 5 small, only half way to v6.

latreillei latreillei, Don. (110-130). The Rose Windmill. Garhwal—Sikkim. R

β. Uph white spot in 5 reaches v6, but does not fill base of space 5.

**latreilleli kabrua, Tyt.* Assam—N. Burma. R.

13 (12). H cilia red from tornus—v3, Uph discal white spot in 5 large and fills base of space 5.

polla, DeN. (110-130). DeNiceville's Windmill. Assam—N. Burma. VR.

14a (11c). Uph very large discal but no submarginal spot in 5 ; those in 2, 3 and 4 prominent.

14 (15a). H tail black. Uph large white spot in 6 and small one in 7.

nevilli, Wm. (100-120). Nevill's Windmill. Assam. VR.

15a (14). H tail red tipped.

15 (16). Uph submarginal spot in 4 red ; no spot in 6. Unh small discal white spot in 4, often visible above.

α. Below body blacker.

**philoxenus philoxenus, Gray.* (110-130). The Common Windmill. Kashmir—Nepal. NR.

β. Below body almost entirely red. Larger.

philoxenus polyeuctes, Db. (120-140). Sikkim—Burma. C.

16 (15). Uph submarginal spot in 4 mostly red.

Uph nearly always white spot in 6. ♀ uph discal white spot in 1-2 above brown ; outer half H black.

dasarada ravana, M. (100-130). The Great Windmill. Kashmir—Kumaon. NR.

β. Uph very rarely discal white spot in 6. ♀ uph no discal white spot in 1-2 ; above entirely black, but females of the *ravana* type occur as rare varieties.

dasarada dasarada, M. (120-140). Sikkim—Assam. NR.

γ. Wings narrower. Unh paler from cell to costa and spot in 6 absent.

dasarada barata, Roth. (120-140). Burma. R.

17a (11b). Uph no white discal spots.

17 (18). Above unmarked. Unh tail red tipped ; red discal spots from 1-2 and submarginal spots to 5, which may show very obscurely above.

crassipes, Ob. (110-120). The Black Windmill. Manipur—Shan States. VR.

18 (17). Tail black. Unh submarginal red spots to 6.

α. Uph complete row nearly white submarginal spots 2-6.

alcinous pembertoni, M. (100-120). Pemberton's Chinese Windmill. Sikkim—Bhutan. VR.

. Uph prominent black submarginal spots and small red submarginal spot in 2. ♀ pale brown, obscure traces of submarginal red spots 3-6.

alcinous tytleri, Evans. Tytler's Chinese Windmill. Manipur. R.

A3. Chilasa.—The Mimes. (Plates I-2).

1a (4a). H v7 twice as far from v8 as from v6. End cell very rounded.

1b (3). Above pale blueish or grey with black veins.

1 (2). Upf black bar across cell in continuation of v5. Uph markings. between margin and cell incomplete.

α. Small. Uph margin dark chestnut, discal and postdiscal spots complete.

agestor govindra, M. (80-100). The Tawny Mime. Kashmir—Kumaon ; NR.

β. Large. Uph margin bright chestnut, postdiscal spots incomplete. Paler and bluer above.

A3. Chilasa—The Mimes (Plates 1-2)—*contd.*

* *agestor agestor, Gray,* (100-120). Sikkim—N. Burma. NR.

2 (1). Upf no black bar across cell. Uph prominent yellow tornal spot.

. Unh costal margin dark up to scv as termen.

epycides epycides, Hew. (70-90). The Lesser Mime. Sikkim—N. Burma. R.

β. Unh costal margin pale, terminal dark area ends at apex.

* *epycides hypochra, Jord.* Shan States—Karen Hills. R.

3 (1b). Upf dark brown, blue spot end cell and blue discal stripes. Uph brown, prominent tornal spot.

a. Upf discal blue stripes nearly to termen. Uph and unh usually no submarginal white markings.

* *slateri slateri, Hew.* (80-100). The Blue striped Mime. Sikkim—N. Burma. R.

. Upf stripes narrower and shorter. H usually with submarginal white markings.

slateri marginata, Ob. Shan States—Karen Hills. R.

γ. Upf blue stripes only half way to termen. H always with submarginal white spots.

slateri tavoyana, But. S. Burma. R.

4a (1a). H. v7 very much nearer 8 than 6 ; dcv 7-6 bowed.

4 (5). Unh no row yellow terminal spots. Upf submarginal whiteish spots in a regular row. Dark brown ; upf blue shot. Typical form with blueish spots upf and white submarginal spots uph. Dimorphic form with upf end cell white and white discal spots ; uph basal half white, black veined.

paradoxa telearchus, Hew. (120-150). The Great Blue Mime. Assam-Burma. R.

* *v. danisepa, But.* VR.

5 (4). Unh prominent row yellow marginal spots. Upf submarginal white spots irregular, spot in 4 shifted in. Typical form dark-brown with white spots ; dimorphic form with pale stripes.

a. Typical form rather pale with very small postdiscal spots. Dimorphic form yellowish brown, markings wide.

clytia lankeswara, M. (90-120). The Common Mime. Ceylon. NR.

v. dissimila, Evans. NR.

β. Typical form dark brown with prominent postdiscal spots of which the apical one may be prolonged inwards and there may be traces of a discal series. The dimorphic form has broad cream white markings typically, but in N.-E. India there is much black dusting causing the pale markings to be restricted. There is a third intermediate form with the forewing as in the first form and the hindwing with pale stripes nearly as extensive as in the second form.

* *clytia clytia, L.* India. NR.

* *v. dissimilis, L.* S. India—N. W. Himalayas. Pale form. NR.

v. dissimillima, Evans. N. E. India—Burma. Dark form. NR.

v. commixtus, Roth. N. E. India. VR.

γ. First form normally with the apical spots upf enlarged into long white streaks. There are two well marked varieties—first var upf white spots absent or replaced by black spots, which may be white centred, and uph with pale streaks sometimes as extensive as in commixtus. Second var above dark indigo blue with obscure dusky postdiscal spots upf and uph pale streaks prominent. Dimorph *dissimillima.*

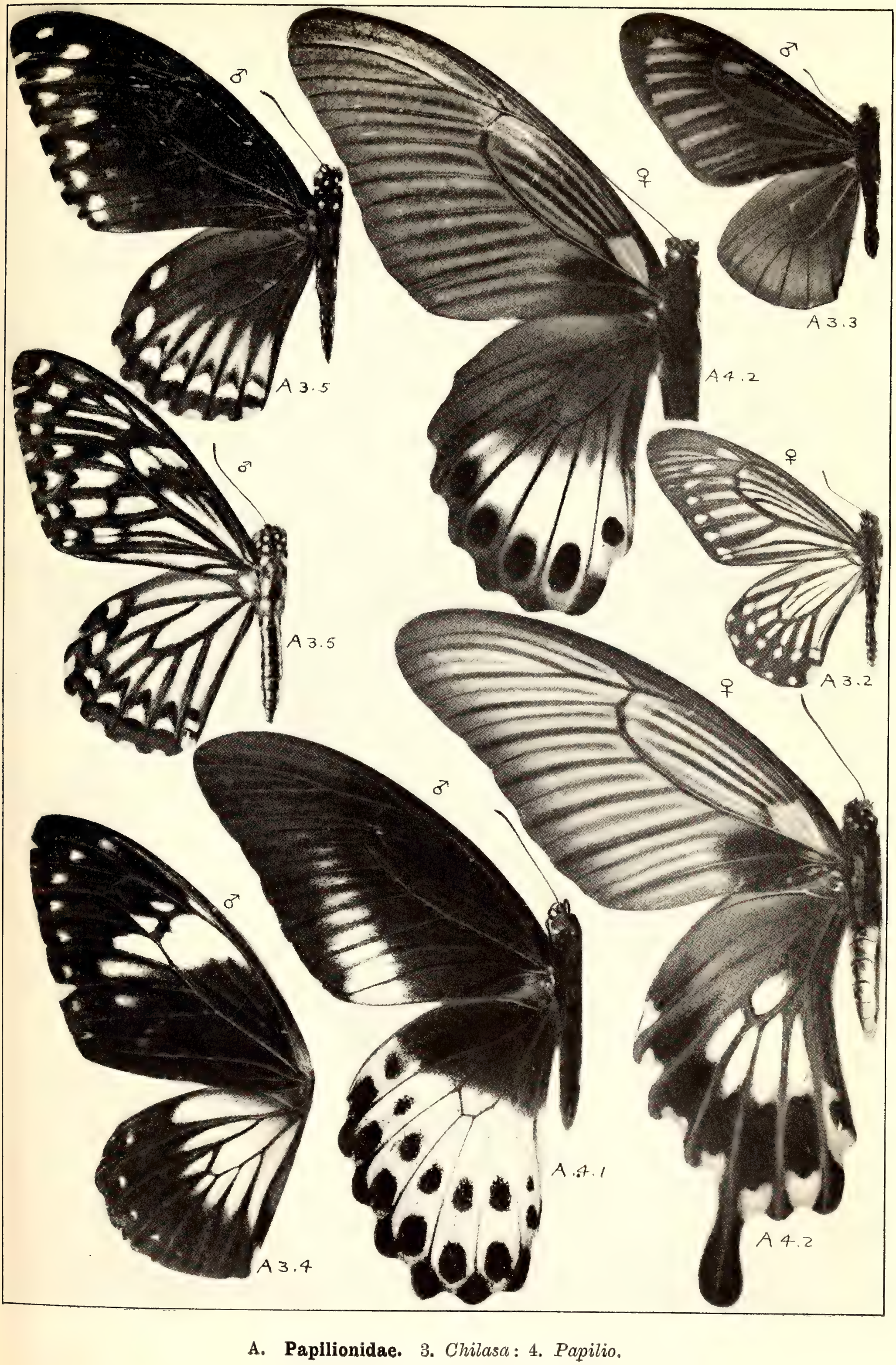
clytia onpape, M. Burma. NR.

v. janus, Fruh. R.

v. papone, Wd. R.

δ. Second form only. Larger ; upf postdiscal spots much enlarged and uph prominent yellow marginal spots.

clytia flavolimbatus, Ob. (120-130). Andamans. NR.


♂
A 3.5
♀
A 4.2
♂
A 3.3
♂
A 3.5
♀
A 3.2
♀
♂
♂
A 3.4
A.4.1
A 4.2

A. **Papilionidae.** 3. *Chilasa*: 4. *Papilio.*

A4. Papilio.—The Black-bodied Swallowtails (Plates 2-5).

1a (6-a). Below prominent red basal markings. Unh cell never sprinkled pale scales.

1b (4a). H width greater than half length.

1 (2.3). ♂ ♀ upf pale blue submarginal band; uph outer ⅔ blue with two rows black spots. Tailless.

. ♂ upf blue band short, not above v4. ♀ blue areas strongly tinged yellow.

polymnestor parinda, M. (120-150). The Blue Mormon. Ceylon. NR.

β. ♂ upf blue band to v5 and to v7 in ♀.

* *polymnestor polymnestor, Cr.* S. India. NR.

2 (1.3). ♂ above blue scaled on a black ground on either side of each vein beyond cell; unh usually red lunules at tornus, which may be replaced by grey or may be extended to costa; tailless. ♀ in 3 forms. 1st (typical) tailless; uph a large white discal area. 2nd tailles, more or less as ♂ above; unh a white streak along dorsum. 3rd tailed, body yellow; uph usually a white spot end cell and a more or less complete row of discal white spots.

* *menon agenor, L.* (120-150). The great Mormon. Sikkim—Burma, Nicobars. C.

♀ *v. butlerianus Roth.* NR.

* ♀ *v. alcanor, Cr.* NR.

3 (1.2). ♂ tailless; black, uph a broad discal blue band. ♀ tailed, rather as *alcanor*, but tail red and white tipped.

mayo, Atk. (120-150). The Andaman Mormon. Andamans. NR.

4a (1b). H long and narrow, width not more than half length.

4 (5). ♂ ♀ alike; tail pink or white tipped. Uph elongated discal white spots in 3-4 or 2-5 and more or less complete row red lunules. Upf covered small whiteish scales. Head above and abdomen below red.

a. Uph tail red tipped. Unh red tornal area in 1 continued to base.

bootes janaka, M. (110-120). The Tailed Redbreast. Garhwal—Abor. R.

β. Uph tail white tipped and usually only 2 discal spots. Unh red tornal area not continued to base.

* *bootes bootes, Wd.* Assam. R.

γ. As last but uph 4 discal white spots.

bootes mixta, Tyt. Manipur and Nagas. R.

5 (4). ♂ tailless; black; uph blue scaled and tornal ocellus white edged. ♀ with very broad tail; upf red streak base cell; uph a large discal white patch and a prominent series double red submarginal lunules, extending to tail.

* *rhetenor, Wd.* (110-130). The Redbreast. Kumaon—Burma. NR.

♂ *v. leococelis, Jord.* Upf white tornal patch. NR.

6a (1a). Below no basal red markings.

6b (8a. 27a). Unh cell all black, not sprinkled yellow or white scales. Sexes alike. Uph blue scaled; tornal red ocellus. Tailless.

6 (7). Unh red submarginal lunules only at apex and tornus, with some discal blue scaling between. Upf no blue scaling; streaks of white scaling on either side of veins. ♂ uph prominent white streak from base under v8.

a. ♂ uph blue scaling in 6 and 7. Unf darker. ♀ browner.

protenor protenor, Cr. (100-130). The Spangle. Kashmir—Kumaon. C.

β. ♂ uph blue scaling 2-7.

* *protenor euprotenor, Fruh.* (110-140). Sikkim—N. Burma. C.

The DSF is considerably smaller than the WSF.

7 (6). Unh red submarginal lunules complete. Upf blue scaling. ♂ upf with woolly stripes on vs1, 2 and 3.

a. Head yellow and body buff at the sides. Uph no red lunules in 2 and 3.

elephenor elephenor, Db. (110-130). The Yellow-crested Spangle. Assam VR.

β. Head and body black.

A4. Papilio.—The Black-bodied Swallowtails (Plates 2-5)—*contd.*

elephenor schanus, Jord. The Black-crested Spangle. S. Shan States. VR.

8a (6b. 27a). Unh basal area including cell sprinkled white or yellow scales.

8b (16a). Above prominent green or blue bands or patches and sprinkled green scales on the black areas. Tailed.

8c (13a). Above no broad green band ; may have a narrow pale or green band upf and a broad green subapical patch uph.

8 (9a). Uph green patch not prominent. Above green scaling dense. Uph submarginal green lunules. ♂ upf woolly streaks on vs 1. 2 and 3. Unf pale discal streaks short.

bianor gladiator, Fruh. (110-130). The Chinese Peacock. Burma. VR.

9a (8). Uph green or blue patch prominent.

9b (11a). Uph green patch of equal width in 5 and 6.

9 (10). Uph inner edge of green patch more or less straight, but ragged and rather diffused, ♂ upf woolly streaks as in last. DSF much smaller than WSF.

α. Upf green band prominent to apex. Unf pale discal streaks obscure and do not enter cell.

polyctor polyctor, Bdv. (90-120). The Common Peacock. Chitral-Kumaon. C.

β. Upf green band present or absent, but rarely to apex. Unf pale streaks long, enter cell and reach termen.

polyctor ganesa, M. (120-130). Sikkim—N. Burma. C.

γ. Upf small white spot at tornus.

ployctor significans, Fruh. S. Burma. NR.

10 (9). Upf inner edge green patch curved and sharp defined. Unf pale discal streaks prominent, but never reach end cell. ♂ no woolly streaks.

α. Unf discal pale streaks not to termen. Large ; uph green patch large, from v3-8 and enters cell.

paris tamilana, M. (120-140). The Tamil Peacock. South India. NR.

β. Unf pale streaks to termen.

paris paris, L. (90-120). The Paris Peacock. Kumaon—Burma. C.

11*a* (9*b*). Uph blue patch much longer in 6 than in 5 ; red submarginal lunules prominent. ♂ no woolly streaks.

11 (12). Upf green postdiscal band. Uph blue patch enters cell and reaches termen in 6.

α. Unf pale discal streaks do not enter cell.

arcturus arius, Roth. (110-120). The Blue Peacock. Kashmir—Kumaon. NR.

β. Unf pale streaks enter cell. Uph blue patch in 6 broken.

* *arcturus arcturus, Wd.* (120-130). Nepal—Burma. NR.

12 (11). Upf narrow pale yellow discal band.

krishna, M. (120-30). The Krishna Peacock. Sikkim—Burma. NR.

13a (8c). Upf and uph broad green discal band.

13 (14*a*). Upf green band does not enter cell. Tail green tipped.

♂ with woolly streaks along vs 1, 2 and 3.

* *crino, F.* (80-100). The Common Banded Peacock. Ceylon. S. India—Bengal. NR.

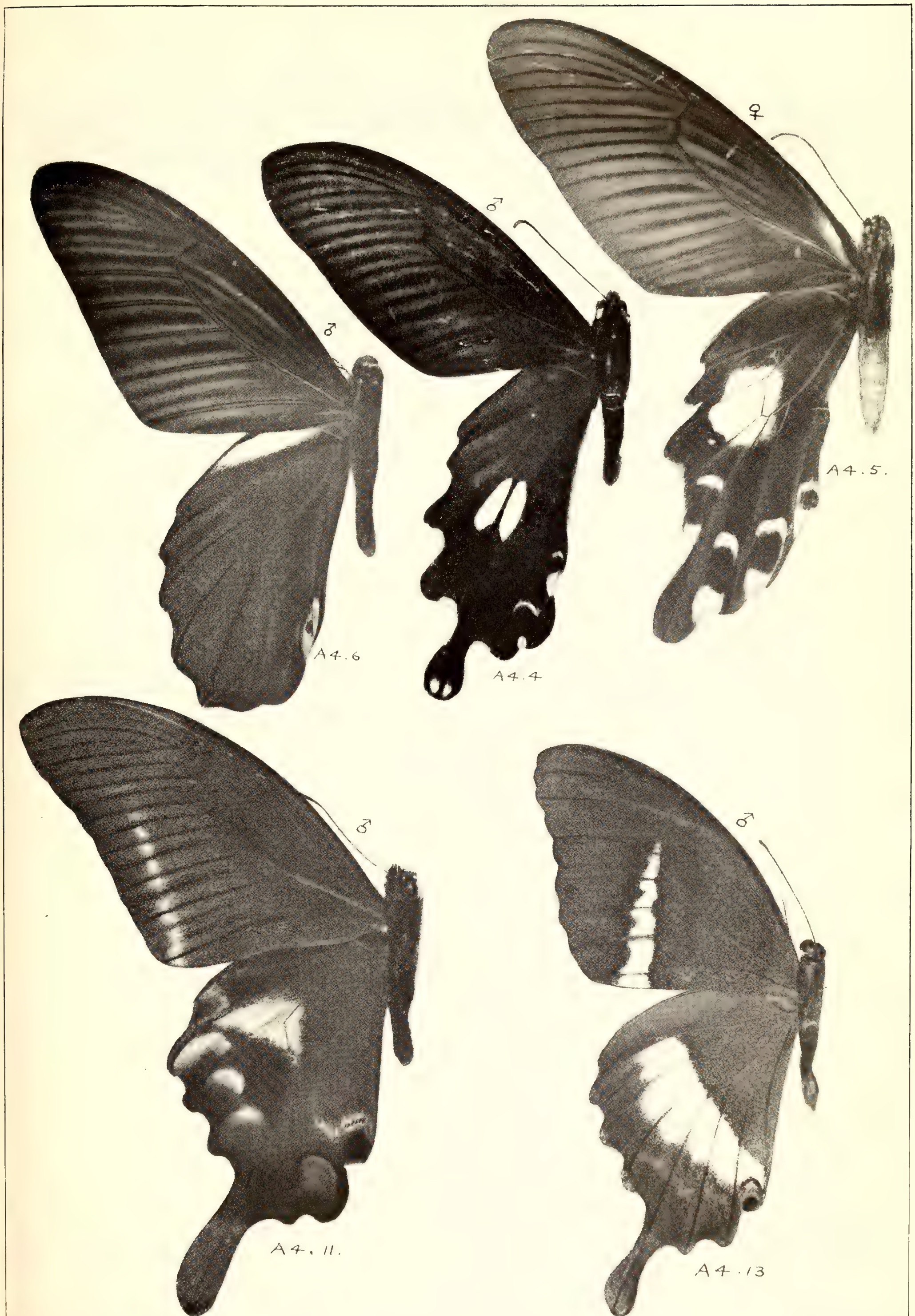
♂ v. *montanus, Fd.* ♂ without the woolly streaks. R.

14a (13). Upf green band enters cell. Uph yellow spot at apex. Tail black. ♂ no woolly stripes.

14 (15). Upf green band broad and broadly enters cell. Uph green discal area large, circular, enters cell.

buddha, Wd. (90-100). The Malabar Banded Peacock. S. India. R.

15 (14). Upf green band narrow, just enters end cell. Uph no green in 2 apical spots and tornal ocellus prominent.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A. **Papilionidae.** 4. *Papilio.*

A4. Papilio.—The Black-bodied Swallowtails (Plates 2-5)—*contd.*

palinurus, F. (90-100). The Burmese Banded Peacock. S. Burma. R.

16a (8b). Above no green or blue bands, patches or scales.

16b (19a). Tailless. Unf and often upf a prominent white spot end cell. Above black, covered yellow scales.

16 (17a). ♂ ♀ upf complete series equal sized submarginal white spots in a regular row. Uph postdiscal white spots short and submarginal series prominent.

dravidarum, Wm. (80-100). The Malabar Raven. S. India. R.

17a (16). ♂ upf no white submarginal spots.

17 (18). ♂ uph complete series equal sized submarginal white spots 1-6, spot in 7 smaller; submarginal row prominent. ♂ upf row of very small submarginal spots, decreasing to specks in 5-7, 8 larger; uph as ♀, spots dusky and decreasing to apex.

* *mahadeva, M.* (80-120). The Burmese Raven. Shan States—Karens. R.

18 (17). ♂ uph large discal white spots 4, 5, 6 to end cell and spot in 7 half length of spot in 6. ♂ upf with submarginal spots.

a. ♂ uph and unh discal spots only 4-7, 4 small, no submarginal spots. ♀ upf submarginal spots small; obscure discal grey streaks 1-4; uph all spaces and outer half cell dusky grey up to the dark submarginal band, bearing white crescents.

* *castor polias, Jord.* (100-130). The Common Raven. Sikkim. NR.

β. ♂ same; unh often discal spot in 3 and may be a complete row; uph traces of submarginal spots at apex. ♀ discal grey streaks absent; uph streaks white.

castor castor, Wd. Assam—N. Burma. NR.

γ. ♂ uph submarginal spots complete and sometimes the discal ones also. ♀ upf submarginal spots increasingly prominent towards apex; uph only post discal series dusky grey spots as in No. 17.

castor mehala, Gr. S. S. Burma. R.

19a (16b). Tailed.

19b (26). Upf no prominent pale discal band from dorsum to apex.

19c (24a). Uph large white subapical patch.

19d (22a). Unh pale scales in cell arranged in 3 prominent streaks.

19e (21). Unh submarginal lunules red. ♂ upf outer half covered dense hairs, concealing yellow scaling.

19 (20). Uph white area 5-7. Unh complete row submarginal red lunules.

a. Unh blue lunules beyond the white discal spots, often continued to dorsum.

helenus mooreanus, Roth. (115-130). The Red Helen. Ceylon. NR.

β. Unh no blue lunules. Unf pale discal streaks short, do not reach termen or enter cell.

helenus daksha, M. S. India. NR.

γ. Smaller. Unf pale streaks reach termen and enter cell.

helenus helenus, L. (110-120). Mussoorie—Burma. C.

20 (19). Uph discal white area 4-7. Unh only submarginal red lunules in 1 and 2; discal blue lunules 2-4. Unf pale streaks short.

iswara, White. (130-150). The Great Helen. Mergui VR.

21 (19e). Unh submarginal lunules yellow, complete; no blue lunules; small discal yellow spots 1-3. Uph white area 4-7 and often spot base 3. Unf white spot in 1.

* *chaon chaon, Wd.* (115-130). The Yellow Helen. Nepal—N. Burma. C.

β. ♂ uph white area larger, fourth patch produced into a long point, projecting beyond the third patch.

chaon ducenarius, Fruh. S. Burma. NR.

22a (19d). Unh pale scales in cell uniformly spread.

A4. Papilio.—The Black-bodied Swallowtails (Plates 2-5)—*contd.*

22 (23). Uph discal white area 5-7, sometimes extending unf to 1a and 1. Unh complete row red lunules; white patch has inner edge quite straight and enters cell. Unf pale streaks short.

noblei, DeN. (110). Noble's Helen. Burma. VR.

23 (22). Uph discal white patch 4-7. Unh complete series blue lunules beyond the white patch.

fuscus andamanicus, Roth. (105-115). The Andaman Helen. Andamans. R.

24a (19c). Uph either a discal white band across the wing or a central row of white or red spots.

24 (25). ♂ ♀ alike with a discal white band uph, which is conspicuously wider in the middle. Upf no white submarginal spots. Unh submarginal lunules yellow.

hipponous pitmani, El. (90-100). Pitman's Helen. S. Burma. R.

25 (24). ♂ uph discal white band of even width; uph and unh submarginal lunules red; upf prominent marginal white spots. ♀ in 3 forms. Typical form, uph red discal spots; upf white central and apical band; resembles *hector.* 2nd form as ♂. 3rd form uph white discal spots 2-5, which may enter cell; upf pale brown outwardly with prominent black streaks between veins and no white marginal spots; resembles *aristolochiæ.* Very subject to aberrations.

* *polytes romulus, Cr.* (90-100). The Common Mormon. Ceylon, India. Burma. VC.

♀ *v. cyrus, F.* R.

* ♀ *v. stichius, Hub.* VC.

β. Larger. Uph ♂ marginal red lunules absent. ♀ typical form as ♂. 2nd form as *stichius,* but larger.

polytes nikobarus, Fd. (100-115). Andamans and Nicobars. C.

♀ *v. stichioides, Evans.* C.

26 (19b). Above black with a pale band across both wings; uph submarginal crescents. Unh evenly powdered white scales. ♂ upf outer half densely hairy.

α. Upf postdiscal band yellowish, macular throughout. Uph end cell on centre of the discal band.

demolion liomedon, M. (90-100). The Malabar Banded Swallowtail. S. India. R.

β. Upf pale band greenish, lower 4 spots conjoined. Uph end cell beyond the discal band.

* *demolion demolion, Cr.* The Burmese Banded Swallowtail. S. Burma. NR.

27a (6b. 8a). Unh basal area entirely yellow.

27 (28a). Tailless. Upf postdiscal yellow spots irregular. Uph base dark brown, prominent large black ringed blue spot below costa.

α. Upf discal spot 1a no larger than spot in 3. Unh black area end cell not half way to origin v7.

* *demoleus demoleus, L.* (80-100). The Lime Butterfly. Ceylon, India, N. Burma. VC.

β. Upf spot in 1a much wider than spot in 3. Unh black area end cell not half way to origin of v7.

demoleus malayanus, Wall. S. Burma. C.

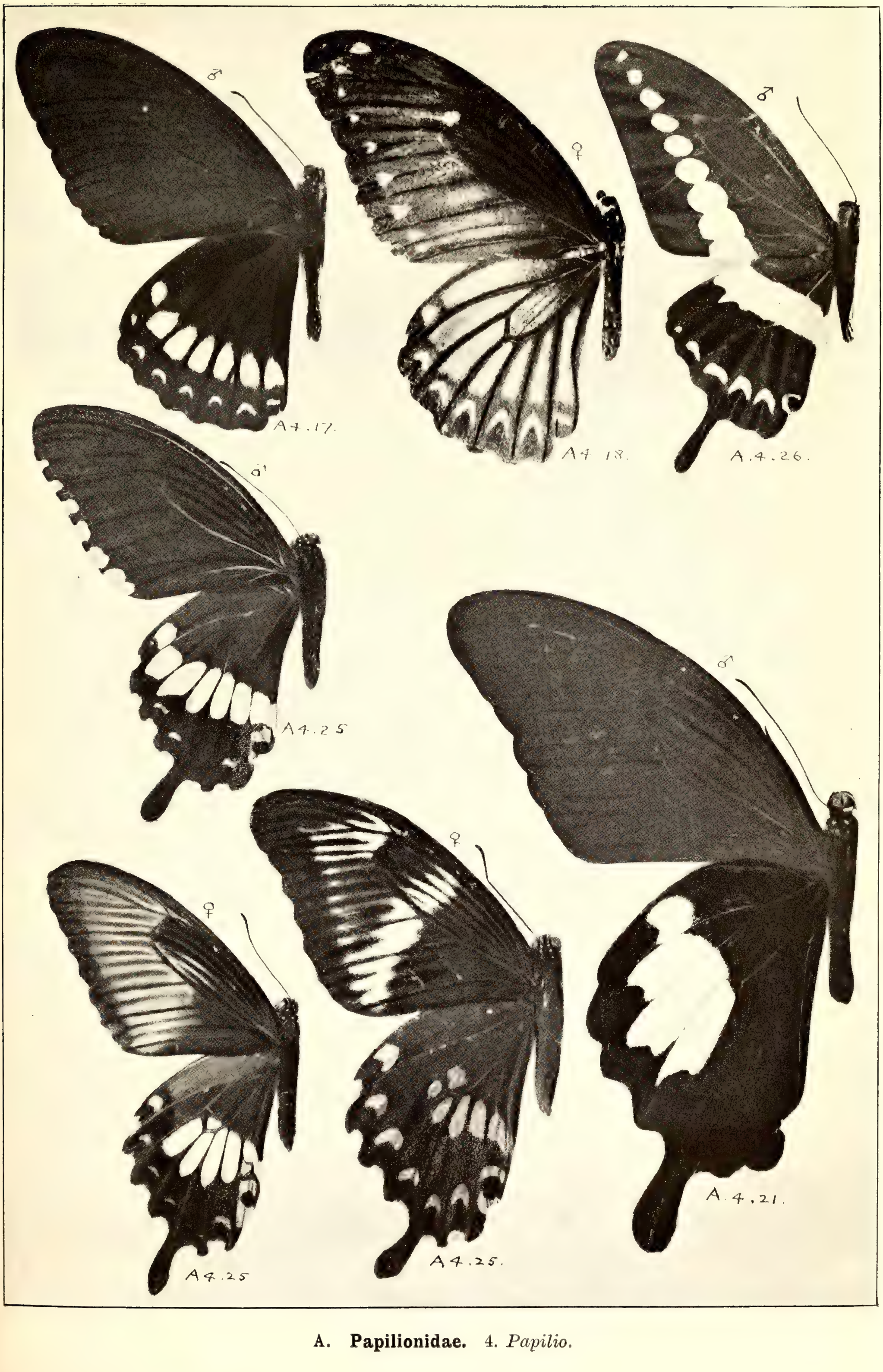
28a (27). Tailed.

28 (29a). Above veins not black; entirely yellow with narrow black bands, the discal band being blue centred.

alexanor, Esp. (75-90). The Baluchi Yellow Swallowtail. Baluchistan. VR.

29a (28). Above veins black. Upf regular row submarginal spots.

29 (30). Upf basal ¼ black, sprinkled yellow scales.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A. **Papilionidae.** 4. *Papilio.*

A4, Papilio.—The Black-bodied Swallowtails (Plates 2-5)—*contd.*

α. Uph blue lunule above tornal red spot conjoined to it ; dark discal band very near end cell.

machaon asiatica, Men. (75-90). The Common Yellow Swallowtail. Baluchistan. Chitral—Nepal. C.

v. ladakensis, M. Tail very short. High elevations only. R.

β. Uph blue lunule separated from tornal red spot by a black line ; discal band broader and further from cell.

machaon sikkimensis, M. Sikkim—Bhutan. NR.

γ. Uph tornal red spot very large and not black edged below ; discal band still further from end cell ; dcv 6-7 broad black as well as 5-6. Above darker yellow.

**machaon verityi, Fruh.* Assam—N. Burma. R.

30 (29). Upf yellow streak from base along lower edge cell and basal ¼ cell yellow streaked, not sprinkled yellow scales. Uph yellow streak in 1 to base.

xuthus, L. (75-90). The Chinese Yellow Swallowtail. N. Burma. VR.

A5. Pathysa.—The Swordtails. (Plate 5).

1a (3a). Upf dark bar end cell double, enclosing 2 pale spots ; 4 dark bars in cell.

1 (2). Unh central row of pale spots complete.

α. Upf 4th bar in cell from base not below mv and post discal line not to v1.

eurous cashmirensis, Roth. (60-70). The Sixbar Swordtail. Kashmir—Kumaon. NR.

β. Upf 4th bar extends along v3 and postdiscal line to v1.

eurous sikkimica, Heron. Sikkim—Assam.

2 (1). Unh central row spots consist of only a spot mid 7, end cell and in 2.

**glycerion, Gray.* (65-75). The Spectacle Swordtail. Sikkim—N. Burma. NR.

3a (1a). Upf dark bar end cell single.

3 (4a). Upf only 3 dark bars in cell ; beyond a narrow dark discal and submarginal line, the area between being triangular.

α. Upf. 2nd bar from base to v1 or beyond ; discal bar to v3.

agetes agetes, Wd. (75-90). The Fourbar Swordtail. Sikkim—N. Burma. NR.

β. Upf 2nd bar from base not to v1 ; discal line meets marginal line between v2 and 3. Uph no white submarginal line in 5 and 6.

**agetes iponus, Fruh.* Tavoy—S. Burma. NR.

4a (3). Upf 4 broad dark bars in cell.

4b (6). Unh central row red spots.

4 (5). Upf row pale rounded spots on the broad dark margin, of which the second from the apex is out of line.

α. Uph dark margin does not enclose pale spot in 3 ; unh precostal spur not defined black.

**nomius nomius, Esp.* (75-90). The Spot Swordtail. Ceylon, S. India—Sikkim. NR.

β. Uph dark margin encloses pale spot in 3; unh precostal spur defined black. All dark markings broader.

nomius swinhoei, M. Assam—Karens. NR.

5 (4). Upf a pale green regular chain line, not spots, on the dark margin.

α. Uph no continuous central dark band.

anticrates anticrates, Db. (70-80). The Chain Swordtail. Sikkim—Assam. R.

β. Uph continuous central dark band. Markings broader.

anticrates hermocrates, Fd. Burma. R.

6 (4b). Unh no central row red spots.

A5. Pathysa.—The Swordtails. (Plate 5)—*contd.*

α. Upf marginal band to v1 and submarginal to v2, but do not unite ; subbasal band to dorsum and 2nd from base to v1. Uph no tornal grey area.

antiphates ceylonicus, Eim. (80-95). The Fivebar Swordtail. Ceylon. VR.

β. Upf submarginal and marginal band unite at v3 and reach dorsum. Upf grey tornal area extending as a broad band to the costa.

antiphates naira, M. S. India. VR.

γ. Very variable. Upf 2nd bar from base to v1 ; postdiscal band, if extended below v2 unites with the marginal band. Uph grey tornal area prominent but confined to tornus.

* *antiphates pompilius, F.* Sikkim—Burma. C.

δ. All markings much broader. Upf 2nd bar from base to dorsum ; discal bar curved under bar end cell as in β. Uph grey tornal area extended to costa as a broad band, but is black at apex.

antiphates epaminondas, Ob. Andamans. NR.

A6. Zetides.—The Bluebottles and Jays. (Plate 5).

1a (3a). Uph no submarginal row green spots.

1 (2). H long tail. Upf transparent green ; black margin along costa and termen united by 4 black lines towards apex.

**cloanthus, Wd.* (85-95). The Glassy Bluebottle. Kashmir—Burma. NR.

2 (1). H tail very short. Black with green band across wings, which becomes macular towards the apex F.

α. Upf apical part of discal band yellowish green. Uph mv black on the discal band.

sarpedon teredon, Fd. (80-90). The Common Bluebottle. Ceylon, S. India C.

β. Above band broader and nearly uniformly coloured. Uph mv mostly white on the discal band. H tail shorter.

**sarpedon sarpedon, L.* Kashmir—Burma. C.

3a (1a). Upf row green submarginal spots.

3b (8). Upf cell spots single. Tailless.

3c (6a). Unh costal dark bar towards base not continued to origin v7 and veins on disc not black. Above markings pale bluish green.

3 (4a). Unh costal bar separated from basal dark band, bar red centred. Unh extreme end cell brown.

α. Uph costal bar coalesced to basal dark band ; upf lower of 2 submarginal spots in 1 rarely present. H tooth at v4 prominent. Upf subbasal green line often absent. Uph mv thick black on the discal band.

doson doson, Fd. (70-80). The Common Jay. Ceylon. C.

β. Uph mv less black on inner part of discal band. H tooth v4 not prominent. Upf subbasal green line prominent.

doson eleius, Fr. S. India—Bengal. C.

γ. Uph costal bar separate from basal dark band. Above discal band wider. Upf 2nd submarginal spot in 1 nearly always present.

**doson axion, Fd.* Kumaon—Burma. C.

4a (3). Unh costal bar united to basal band ; extreme end cell red.

4 (5). Upf only one submarginal spot in 1. ♂ scent wool forms a narrow stripe. Abdomen above black.

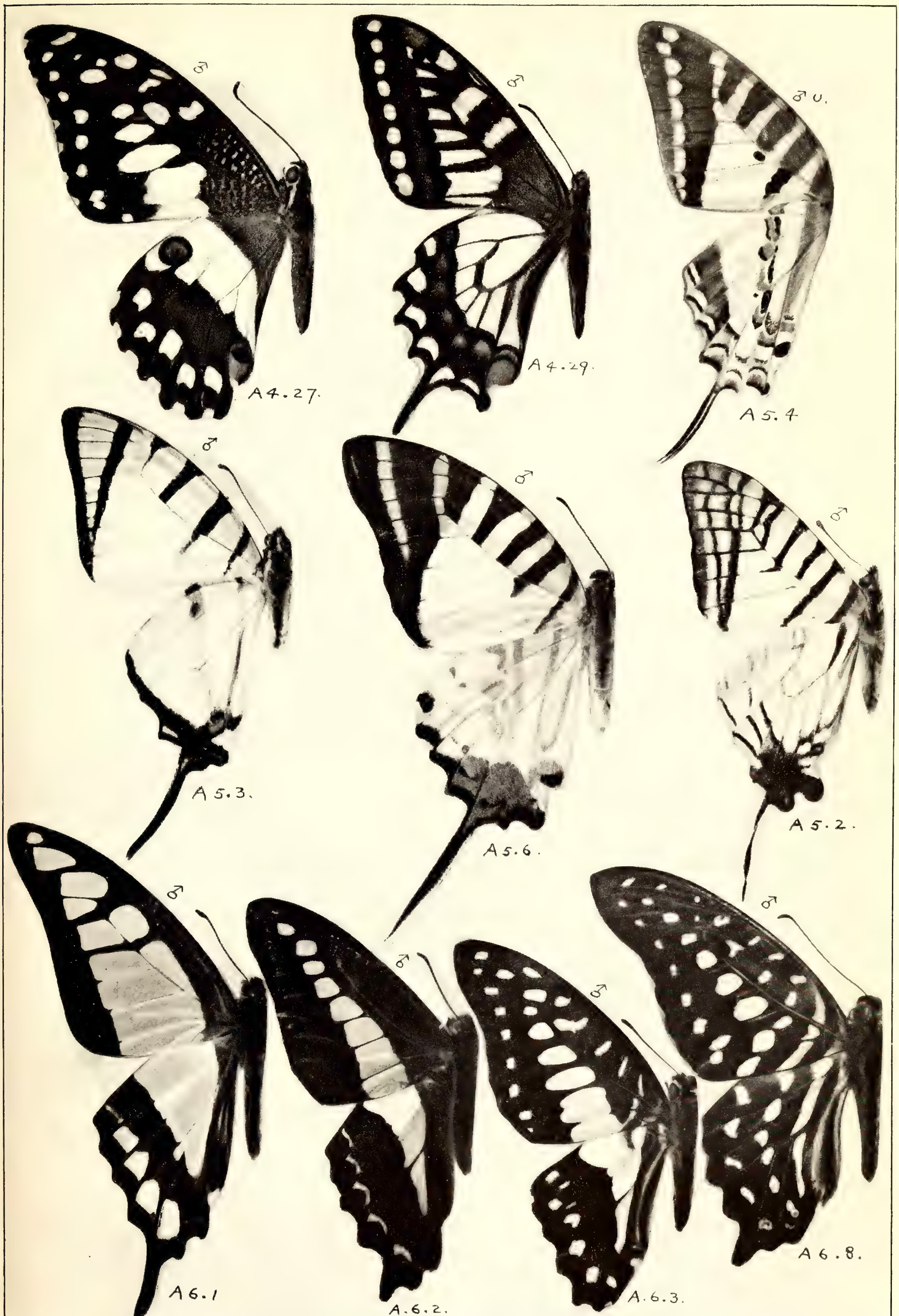
Unh costal bar red centred. Upf spot near base 5.

evemon albociliatis, Fruh. The Lesser Jay. Assam—Tavoy. R.

β Unh costal dark bar all black. Upf no spot near base 5.

evemon orthia, Jord. Mergui—S. Burma. R.

5 (4). Upf always 2 submarginal spots in 1. Unh costal bar red centred: Abdomen above whitish. Very rarely the costal bar unh is not joined to the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A6.8

A. **Papilionidae.** 4. *Papilio*: 5. *Pathysa*: 6. *Zetides.*

A6. Zetides.—The Bluebottles and Jays. (Plate 5)—*contd.*

basal bar and then the basal margin of the silver band between is notched at scv.

α. Uph ends some veins black on the green band. Unh no pale spot base 3. Unf 2 submarginal spots in 7 conjoined.

eurypylus cheronus, Fruh. (75-90). The Great Jay. Sikkim—Burma. NR.

β. Bands above very broad and no dark veins on the band uph. Unh pale spot base 3. Unf 2 submarginal spots in 7 separate.

eurypylus macronius, Jord. Andamans. NR.

6a (3c). Unh costal dark bar continued to origin v7 and all veins on disc black.

6 (7). Uph cell all pale. Above pale green with broad markings. Unh costal bar all black, but spot internal to it pale yellow; discal spots orange, not red.

bathycles chiron, Wall. (75-100). The Veined Jay. Sikkim—Burma. NR.

7 (6). Uph cell dark with 2 green spots. Above spotted as No. 8, but smaller, markings bright green. Unh costal bar red centred and discal spots red.

arycles, Bdv. (70-80). The Spotted Jay. Shan States—S. Burma. R.

8 (3b). Upf cell spots double. Above black, markings small and bright green. H short tail.

α. Tail always longer.

agammemnon menides, Fruh. (85-100). The Tailed Jay. Ceylon, S. India. C.

β. Tail always shorter.

**agammemnon agammemnon, L.* Kumaon—Burma. C.

γ. Above markings much greyer green.

agammemnon andamana, Lathy. Andamans. C.

δ Unh 5 to 7 light red spots.

agammemnon decoratus, Roth. Nicobars. C.

A7. Paranticopsis.—The Zebras. (Plate 6).

1a (3). Uph discal streaks in 3,4 and 5 entire.

1 (2). Unh tornal yellow spot very small; usually dark bar in cell formed by continuation of v4. Unf discal spot just below v8 rarely present as a dot.

α. ♂ broad white stripes. ♀ as ♂, white stripes broader than the black ones.

macareus indicus, Roth. (80-100). The Lesser Zebra. Sikkim. NR.

β. ♀ very dark, white stripes much narrower than the dark ones.

mecareus lioneli, Fruh. Assam. NR.

γ. ♂ white stripes narrower. ♀ as ♂ but white spots on apical half F and outer half H narrower.

macareus gyndes, Jord. N. Burma—Tavoy. R.

δ. ♂ white markings very broad, upper discal streak conjoined to spots beyond cell; upf cell bars broad and complete, but unf each broken into 3 spots. ♀ as β but apex F much darker and spots thereon quite white, while rest are sullied; upf discal streaks in 2 and 3 short, do not nearly reach base; cell bars much reduced.

macareus perakensis, Fruh. Mergui—S. Burma. R.

2 (1). Unh tornal yellow spot very large; very rarely dark bar in cell formed by continuation of v4. Upf discal spot below v8 always prominent.

α. ♀ as ♂.

xenocles phrontis, DeN. (85-120). The Great Zebra. Sikkim. NR.

β. ♀ much darker and pale stripes much narrower.

**xenocles xenocles, Db.* Assam. NR.

γ. As α but pale stripes narrower.

xenocles kephisos, Fruh. Burma. R.

A7. Paranticopsis.—The Zebras. (Plate 6)—*contd.*

3 (1a). Uph discal streaks in 3, 4 and 5 divided into small spots. All pale markings very small.

a. Upf cell spots very small and unf nearly absent.

**megarus megarus, Wd.* (65-90). The Spotted Zebra. Assam—N. Burma.

β. Upf and unf cell spots well developed.

megarus similis, Lathy. Shan States—S. Burma. R.

A8. Meandrusa.—The Hooked Swallowtails. (Plate 6).

1 (2). Below basal ¼ dark chocolate brown. ♂ above dark brown with yellow submarginal spots. ♀ broad discal white band, interrupted beyond end cell F. Apex F produced.

**gyas gyas, Wd.* (105-115). The Brown Gorgon. Sikkim—Assam. R.

β. ♂ below central area lighter. Upf spots smaller.

gyas aribbas, Fruh. Upper Burma. VR.

2 (1). Below basal area orange yellow, brown spotted. Above orange yellow yellow spotted dark brown margins upf and discal band uph. Apex F falcate.

a. Uph no discal yellow spot in 5.

**payani evan, Db.* (110-130). The Yellow Gorgon. Sikkim—Assam. NR.

β. Uph discal yellow spot in 5 and upf well defined dark brown line v3-v7 along inner edge of dark marginal area, separating off small yellow spots.

payeni amphis, Jord. N. Burma—Karens. R.

A9. Teinopalpus.—The Kaiserihind. (Plate 6).

Above green, ♂ with prominent yellow upper discal area uph; ♀ with this area grey and 2 grey bands upf. Below ♂ basal half green, outer half yellow brown; ♀ mostly grey.

a. ♂ uph yellow discal area enters end cell and ends just before v3. Smaller.

**imperialis imperialis, Hope.* (90-120). The Kaiserihind. Sikkim—Assam. R.

β. ♂ uph yellow discal area scarcely enters end cell and ends on v2. ♀ uph darker, yellow dorsal area to v3.

imperialis imperatrix, DeN. N. Burma—Karens. R.

A10. Leptocircus.—The Dragontails. (Plate 6).

1 (2). Above band white, constricted on upf towards centre. Tarsal claw with a tooth. ♂ with scent organ.

curius, F. (40-50). The White Dragontail. Assam—Burma. NR.

2 (1). Above band green and black band beyond of nearly even width throughout. Tarsal claw simple. ♂ no scent organ.

a. Unh white band along dorsum towards tornus ill defined and widely separated from latter.

meges indistincta, Tyt. (40-55). The Green Dragontail. Assam—N. Burma NR.

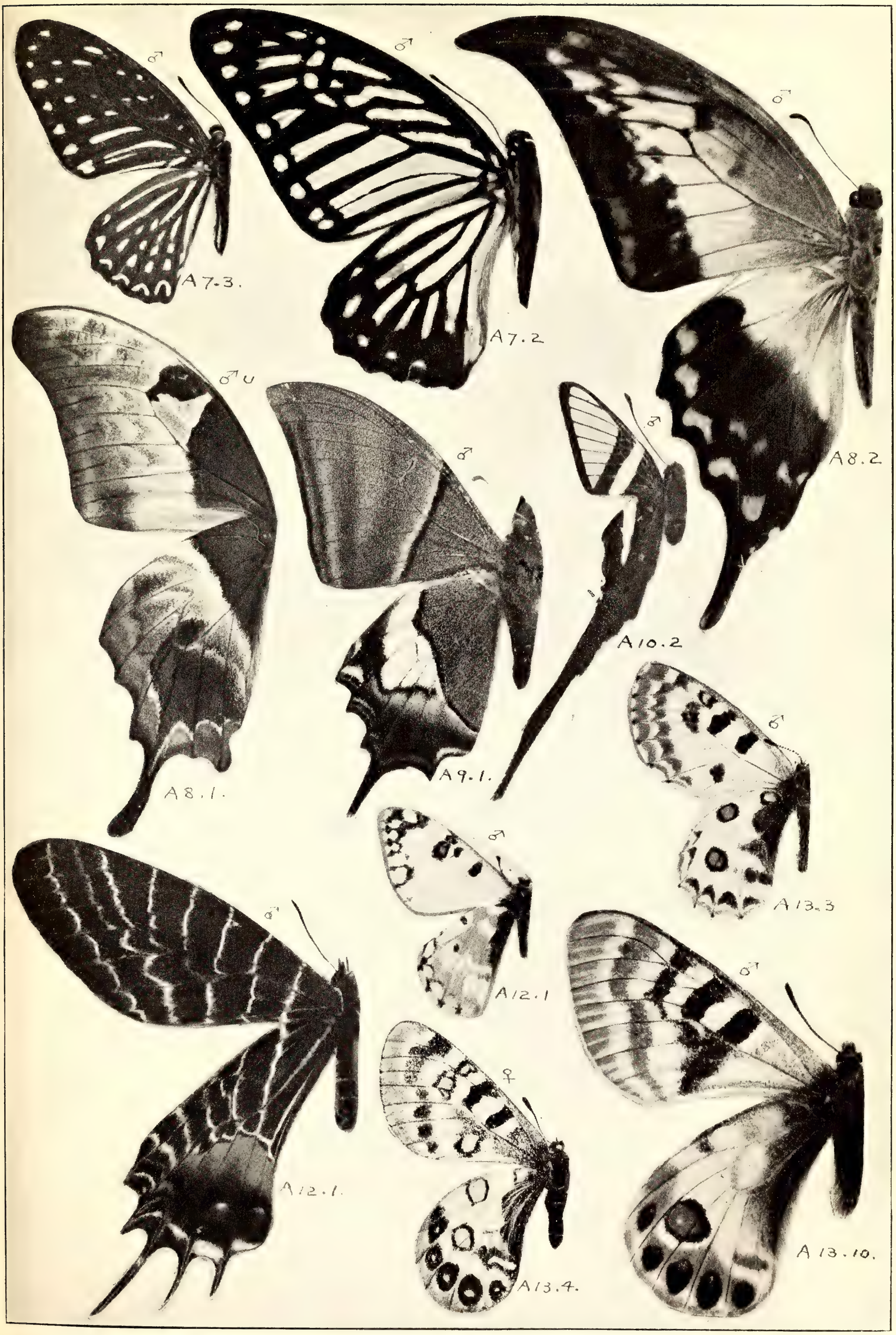
β. Unh white band along dorsum towards tornus well defined and closer to latter.

**meges virescens, But.* Karens—S. Burma. C.

A11. Armandia.—The Bhutan Glory. (Plate 6).

Above black with narrow white lines; uph tornus with 2 or 3 blue and white ocelli on a black area, crowned by a large red area, which is posteriorly yellow. Long tail at v4, short tails at vs 2, 3 and 5.

**lidderdalei, Atk.* (90 110). The Bhutan Glory. Bhutan, Naga and Chin. Hills. R.


♂
A7.3.
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A8.1.
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A13.3
♂
A12.1
♂
A12.1.
♀
A13.4.
♂
A13.10.

A. **Papilionidae.** 7. *Paranticopsis*: 8. *Meandrusa*: 9. *Teinopalpus*: 10. *Leptocircus*; 11. *Armandia*: 12. *Hypermnestra*: 13. *Parnassius*.

A12. Hypermnestra.—The Desert Apollo. (Plate 6).

Above cream white. Upf black spot in and at end cell; just beyond cell double, black ringed, red spot. Unh white with irregular greenish patches and obscure red spots base costa and on disc.

**helios balucha, M.* (45-55). The Desert Apollo. Baluchistan.

A13. Parnassius.—The Snow Apollos. (Plate 6).

The spotting and venation very variable and no single character can be taken as absolutely reliable.

1a (4a). F v7 ex 6; 10 and 11 free. Antennæ white ringed. Unh red basal spots complete; uph never blue spots. Upf usually 2 red spots end cell, red spot mid 1 and no connecting dark area or band. Uph red spot base 7; 3 discal red spots, *viz.*, mid 7 between vs4-6, in 1-2, latter being more often black above; submarginal row black lunules. ♀ pouch brown, boat shaped below, pointed in front.

1b (3). ♀ pouch posteriorly keeled. Upf cilia not or hardly chequered; vitreous dark marginal area very wide, as wide or wider than the submarginal white and post discal black bands together.

1 (2). Very large with large red spots.

discobolus, Alph. (70-80). The Larger Keeled Apollo. Chitral. R.

2 (1). Smaller.

a. Small and very white, very little black scaling.

jacquemontii chitralensis, M. (55-70). The Keeled Apollo. Chitral. NR.

β. Large; often much black scaling; sometimes yellowish.

jacquemontii jacquemontii, Bdv. (65-75). Kashmir—Kumaon. R.

3 (1b). ♀ pouch not keeled. Upf cilia prominently chequered; vitreous dark marginal area narrow.

a. Comparatively large and white.

**epaphus epaphus, Ob.* (50-60). The Common Red Apollo. Chitral—Kumaon. NR.

β. Small and dark.

epaphus sikkimensis, El. (40-50). Sikkim. C.

4a (1a). F v7 not ex 6. Antennæ black, not white ringed, but sometimes scaled yellow or whitish.

4b (7a). F vs 10 and 11 not anastomosed, but may touch.

4 (5a). F vs 6 and 7 from a point and origin v10 far removed. Uph complete submarginal row blue and white centred black spots on a white ground, though margin may be blackish. Unh prominent red basal spots. Upf spots end cell and mid 1 usually red but not joined by a dark band. Uph not as a rule a red spot base 7; remaining discal spots prominent. Unh submarginal spots greenish. Two broods, DSF pale, WSF dark. ♀ pouch white, like a cylinder squashed in at the sides and the projecting lower portion then dented.

a. Comparatively large.

**hardwickei hardwickei, Gray.* (55-65). The Common Blue Apollo. Chitral—Kumaon. C.

β. Smaller.

hardwickei viridicans, Fruh. (50-60). Sikkim. C.

5a (4). F vs 6 and 7 separate at the base; usually bases 6, 7 and 10 equidistant. Upf spots end cell and mid 1 black and joined by a dark band. Uph blue centred black submarginal spots in at least 2 and 3; beyond to costa there may be a complete series of similar spots or a dark wavy line.

5 (6). Comparatively small. Unh basal red spots obsolete. Uph no red spot base 7 and discal spots not white centred. ♀ pouch surrounds end abdomen, like a cylinder squashed flat from below and the end split, resulting in 2 divergent points.

A13. Parnassius.—The Snow Apollos. (Plate 6)—*contd.*

α. H angled at v7. Upf discal band obsolete ; postdiscal dark band in ♂ not to dorsum. Uph discal spots 5 and 7 prominent red, equal sized ; spots 1 and 2 obsolete ; only blue submarginal spots in 2 and 3 ; marginal dark area faint.

delphius kafir, Avin. (55-65). The Kafir Banded Apollo. Safed Koh—Kafiristan. VR.

β. Upf postdiscal and discal bands conjoined in 3. Uph discal red spot in 5 prominent ; 7 smaller black or red ; only blue spots in 2 and 3.

delphius chitralica, Ver. The Chitral Banded Apollo. Chitral. VR.

γ. Very washed out pale form with reduced markings. Upf no discal band or spot in 1. Uph no discal spot in 7 ; spot in 1 small and black ; margin dark ; only blue spots in 2 and 3 and the wavy line beyond obsolete.

delphius hunza, Groum. The Hunza Banded Apollo. Hunza. VR.

δ. Upf discal and postdiscal bands narrow, complete, sharp defined. Uph discal spot 5 prominent, spot mid 7 black, just indicated or absent ; submarginal blue spots usually complete and on dark area, which does not reach the margin, but sometimes there are only blue spots in 2 and 3 with a dark wavy line beyond ; discal spots 1 and 2 often red and usually indicated.

delphius nicevillei, Avin. The Astor Banded Apollo. Astor, Western Kashmir. R.

η. Upf much as last, may be washed out looking in ♀. Uph discal red spot 5 very large, from v4-6, spot mid 7 small, black : always discal red spots 1 and 2 ; submarginal blue spots complete and on a dark ground that reaches the margin.

delphius atkinsoni, M. The Pir Panjal Banded Apollo. E. and S. Kashmir. VR.

ξ. Upf postdiscal dark band very broad, as broad as marginal dark band ; white submarginal spots small and end at v2 ; discal band often incomplete posteriorly. Uph discal spot in 5 variable ; spot in 7 usually absent; submarginal blue spots complete and on a broad dark area to margin ; discal spots in 1 and 2 prominent or absent.

delphius stoliczana, Fd. The Ladak Banded Apollo. Ladak—Kulu. VR.

ε. Upf very white with narrow complete bands. Uph basal black scaling up to inner edge of discal spots 5 and 7, which are red and equal ; no spots 1 and 2 ; submarginal blue (sometimes black) spots in 2 and 3 only and wavy line beyond prominent ; margin white.

delphius lampidius, Fruh. The Sikkim Banded Apollo. Sikkim. VR.

θ. As last but much larger and very dark. Upf almost completely black scaled and uph black scaled to outer edge of discal spots, which are small and equal ; margin narrow black.

delphius latonius, Bryk. (55-65). The Thibet Banded Apollo. Sikkim—Phari Jong. VR.

6 (5). Large. Unh basal red spots prominent . Uph red spot base 7. Above general tone yellowish. Upf black bands broad, complete, considerable black scaling. Uph discal spots 5 and 7 large, white centred ; from spot in 5 a black band to dorsum ; submarginal blue spots 2 and 3 large and wavy line to costa broad ; margin broadly pale. ♀ pouch as last, but sides broken and separated from body.

imperator augustus, Fruh. (80-90). The Imperial Apollo. Sikkim. VR.

7a (4*b*). F vs 10 and 11 anastomosed.

7b (10). F vs 10 and 7 well separated at base, 7 and 6 approximate. Comparatively small. Uph all submarginal spots black. Uph discal band more or less complete, no red spots.

7 (8a). Upf cilia black. Uph always small red discal spots 5 and 7, no spot base 7 ; unh red basal spots. ♀ pouch black with 2 long contiguous points.

A13. Parnassius.—The Snow Apollos. (Plate 6)—*contd.*

a. Upf marginal dark area broad ; postdiscal band prominent ; discal band slender. Uph discal spots small ; sub-marginal spots small and separate ; margin narrowly dark.

simo simo, Gray. (45-55). The Black-edged Apollo. Ladak. VR.

β. Upf marginal dark area reduced to a thin line, thickened at ends veins; white submarginal spots and postdiscal dark band very broad. Uph black spot in 7 behind the red spot ; from discal spot in 5 a more or less complete black band to dorsum ; submarginal black band broad and continuous, margin white with black veins. VR.

simo acconus, Fruh. Sikkim.

8a (7). Upf cilia pale yellow or white. ♀ pouch white, hangs down as a pendulous bag, squashed flat at the sides.

8 (9). Above very white no red spots at all. Very small. Upf discal band more or less complete ; postdiscal dark band, submarginal white spots and marginal dark band all of equal width. Uph discal spots 5, mid 7 and base 7 small and black : more or less continuous discal band from 7 to dorsum ; basal black scaling very reduced ; submarginal spots small, well separated, margin white.

hannyngtoni, Avin. (40-45). Hannyngton's Apollo. Sikkim—S. Thibet. VR.

9 (8). Uph with red spots.

a. As *β* but very washed out.

acco acco, Gray. (40-60). The Varnished Apollo. Ladak. VR.

β. Upf white submarginal spots unusually sharp, veins broadly black especially 2, 3 and 4. Uph prominent red spot 5, mid 7, base 7 and a black spot in between the two latter ; spot in 5 joined to dorsum by a black band and usually a black spot between 5 and 7 ; submarginal spots prominent, well separated, margin narrowly black. Unh has a varnished yellow appearance, concealing the basal red spots except that in 7.

acco, gemmifer, Fruh. (45-65). Sikkim. VR.

10 (7b). Very large. F v10 ex 7 ; 6 and 7 well separated at origin. Upf discal band usually broadened below cell, bases 2 and 3 usually entirely black ; no red spot. Uph no spot base 7, small red or black spot mid 7 ; very large red spot extending from v4-6, usually white centred and a red or black basal bar in 1-2 ; complete row blue centre black submarginal spots on a dark ground margin narrowly dark. ♀ pouch very large, cornute. Unh red basal spots obscure.

**charltonius, Gray.* (80-90). The Regal Apollo. Chitral—Kumaon. R.

Notes on the *Papilionidæ*. The genera *Troides* to *Meandrusa* are usually dealt with under *Papilio*, which genus Moore split-up into numerous genera ; the genera adopted here appear natural and easily recognisable.

The following are new names :—*zaleucus* ♂ v. *punctata* ; *alcinous tytleri* (= *mpediens, Tyt nec Roth*) *clytia v. dissimila* and *dissimillima.*

It is questionable whether *rhodifer* should not be regarded as a race of *coon* and *polymnestor* and *mayo* as races of *memnon*. *mahadeva* may be a dimorphic form of *castor m·hala.*

Additional races have been described for many of the species, more especially in the genus *Parnassius* ; I have only included what appear to me to be really well defined races. Aberrations and infrequent varieties have been omitted.

Byasa sycorax (A 2-4) has not been recorded from India before. A specimen was obtained in the Mergui District by Mr. G. R. E. Cooper in April 1922. A specimen of *Troides amphrysus* (A 1-5) has recently been received from Mergui by Mr. O. C. Ollenbach.

Note on plates.—The number under each figure in the plates is that given in the keys, where a star indicates that the insect has been figured.

Note on rarity.—VC=very common. C=common. NR=not rare. R=rare. VR.=very rare.

B. Pieridæ. The Whites. Genera Key.

1a (3a). F v5 ex 6; v9 absent. H precostal straight, directed back. Palpi slender, hairy.

1 (2). F v8 absent; upper apex of cell acute, dcvs concave, H v8 as long as cell. Antennæ club slender.

Leptosia, Hub. The Psyche. (Plate 7).

2 (1). F v8 present, very short; upper apex of cell obtuse, dcvs nearly straight. H v8 half as long as cell. Antennæ club spatulate.

Baltia, M. The Dwarf Whites. (Plate 7).

3a (1a). F vs 5 and 6 separate at origins.

3b (17a). F v6 ex 7 from well beyond end cell.

3c (14a). H with well developed precostal vein.

3d (11a). Palpi slender, hairy, third joint usually long.

3e (9a). F dcv 5-6 not angled.

3 (4a). F upper apex cell acute; vs 5 and 6 approximate at origin, dcv 5-6 short and may or may not be in line with dcv 4-5; v10 from upper end cell; v8 comparatively long; v9 present or absent. H precostal straight. Antennæ with stout club.

Synchloe, Hub. The Little Whites. (Plate 7).

4a (3). F upper apex cell obtuse; v9 absent. H precostal curved forward.

4 (5a). F v8 very short, hardly visible and may be absent; v10 usually from well before end cell and dcv 5-6 unusually long, but first group are transitional to last genus. Antennæ club stout.

Pieris, Schrank. The Bath and Cabbage Whites. (Plate 7).

5a (4). F v8 comparatively long and prominent.

5b (8). F v11, if present, free from 12.

5c (7). F costa smooth.

5 (6). F v11 present. Antennæ club stout.

Aporia, Hub. The Blackveins. (Plate 7).

6 (5). F v11 absent. Antennæ club slender.

Delias, Hub. The Jezabels. (Plate 7).

7 (5c). F costa serrate in ♂; v11 present. Antennæ club slender.

Prioneris, Wall. The Sawtooths. (Plate 8).

8 (5b). F v11 anastomosed to v12. Antennæ club slender.

Anaphaeis, Hub. The Pioneer. (Plate 7).

9a (3e). F dcv 5-6 angled; v10 well before end cell; 11 and 8 present, 9 absent. H precostal well curved forward. Antennæ club slender.

9 (10). ♂ no abdominal hair pencils. F apex not produced, termen straight or convex.

Huphina, M. The Gulls (Plate 8).

10 (9). ♂ (except *lalassis*) with abdominal hair pencils. Apex F usually produced and may be falcate, termen usually concave.

Appias, Hub. The Puffins and Albatrosses. (Plate 8).

11a (3d). Palpi scaled, short and stout, third joint very short. F v10 from just before end cell.

11 (12a). H precostal short and lumpy. F apex lies between vs7 and 8. ♂ uph white brand base 7; unf tuft white hairs towards base dorsum.

Catopsilia, Hub. The Emigrants. (Plate 9).

12a (11). H precostal slender, curved back.

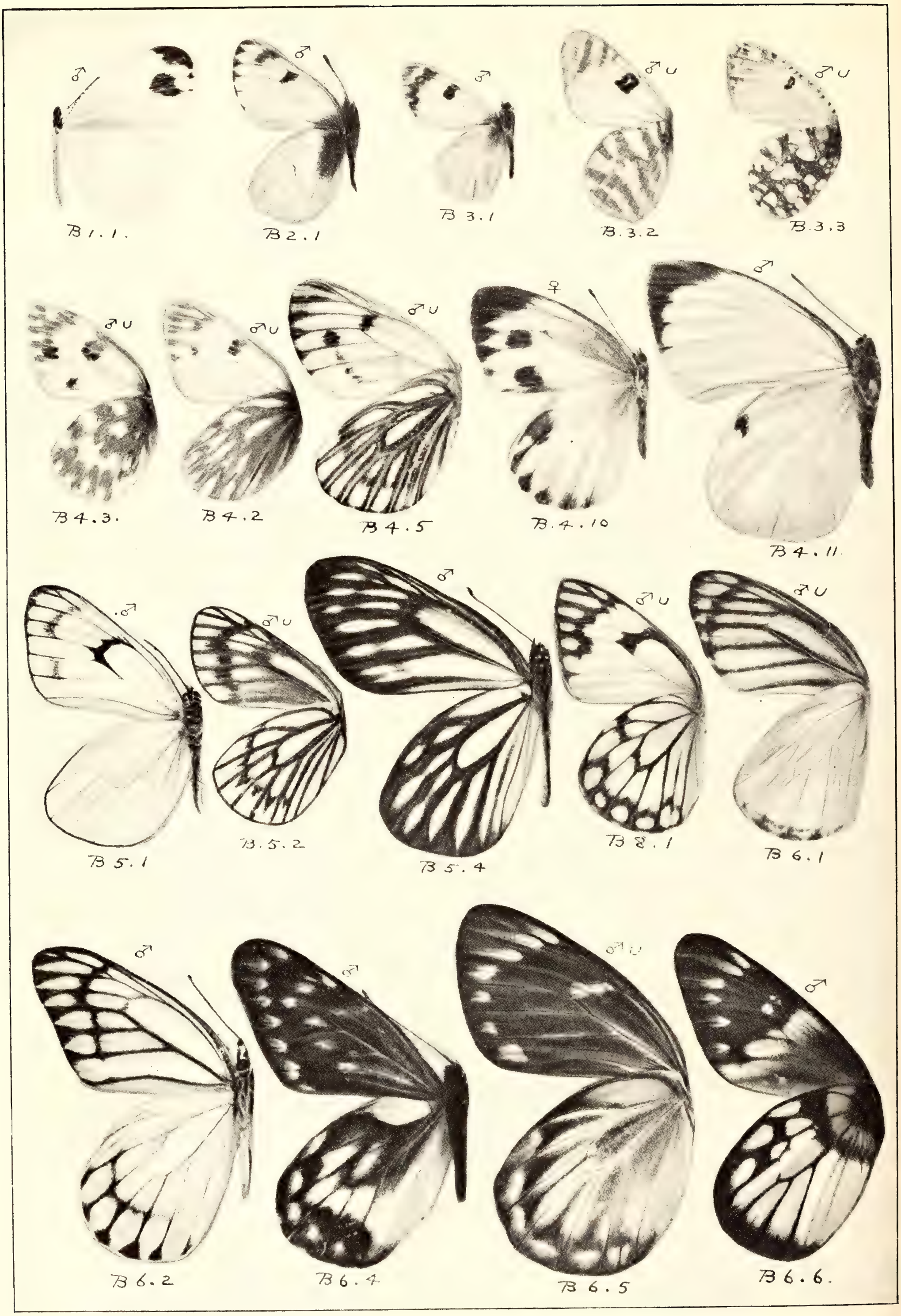
12 (13). F apex at end v7. H rounded v7 well before end cell; dcv 7-6 inclined.

Gandaca. M. The Tree Yellow. (Plate 9).

13 (12). F apex between vs 6 and 7, falcate or pointed.

Dercas, Db. The Sulphurs. (Plate 9).

14a (3b). H no precostal vein.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B. **Pieridae.** 1. *Leptosia*: 2. *Baltia*: 3. *Synchloe*: 4. *Pieris*: 5. *Aporia*: 6. *Delias*: 8. *Anaphaeis*.

B Pieridæ.—The Whites. Genera Key—*contd.*

14b (16). F v10 before end cell.

14 (15). H scv and 7 in a straight line. F falcate and H dentate at v3. Palpi hairy, third joint short. F apex between vs 6 and 7.

Gonepteryx, Leach. The Brimstones. (Plate 9).

15 (14). H scv and v6 in a straight line, 7 from at or just before end cell, dcv 6-5 vertical. Palpi scaled, 3rd joint short.

Terias, Swain. The Grass Yellows. (Plate 9).

16 (14b). F v10 from beyond end cell; apex between vs 7 and 8. Palpi long, hairy, 3rd joint short.

Colias, Fab. The Clouded Yellows. (Plate 9).

17a (3b). F vs 6 and 7 separate or only just forked (except *Ixias pyrene*), Palpi hairy, short, 3rd joint short. H precostal curved forward.

17b (19a). H v8 shorter than v1 F.

17 (18). H v6 not nearer 5 than 7.

Ixias, Hub. The Indian Orange Tips. (Plate 9).

18 (17). H v6 much nearer 5 than 7.

Colotis, Hub. The Little Orange Tips and Arabs. (Plate 9).

19a (17b). H v8 equal to v1 F.

19 (20). F vs 6 and 7 well separated at origin; dcv 6-5 straight, 5-4 angled; v9 absent.

Hebomoia, Hub. The Great Orange Tip. (Plate 9).

20 (19). F vs 6 and 7 from a point; dcv 6-5 angled 5-4 straight; v9 present.

Pareronia, DeN. The Wanderers. (Plate 9)

B1. Leptosia.—The Psyche. (Plate 7).

a. Unmarked white, except upf black apex and large black spot from 3-4 unh striated greenish.

**xiphia xiphia, F.* (35-50). The Psyche. Ceylon. S. India—Mussoorie—Burma. Andamans. C.

β. Upf markings much reduced.

xiphia nicobarica, Doh. Nicobars. C.

B2. Baltia.—The Dwarfs. (Plate 8).

White. Upf prominent black spot end cell; discal costal bar, continued in ♀ as a discal band; marginal black spots more prominent at apex.

1 (2). Unh single dark spot end cell; more or less dusted blackish scales, especially at base in ♂.

**shawi, Bates.* (30-40). Shaw's Dwarf. Chitral—Ladak. NR.

2 (1). Unh 2 dark spots end cell; yellow, veins yellow, broadly defined dark brown and similarly at apex unf.

butleri butleri, M. (35-45). Butler's Dwarf. Ladak—Kumaon. R.

β. ♂ upf complete discal band. Below brighter.

butleri sikkima, Fruh. Sikkim. VR.

Notes on the Pieridæ. The general arrangement is much as usual. *Terias tilaha* is new to India, having been obtained by Mr. G. R. E. Cooper early in 1922 in the Mergui District. *Colias croceus* in Baluchistan is likely to have a white form of female (= ♀ v. *helice, Hub.*) *Colotis phisadia, God* has been excluded; it is an African insect, differing from *protractus* in having a white hindwing; it is recorded from the Punjab, but the specimens obtained are considered to be aberrations of *protractus*

B3. Synchloe.—The Little Whites. (Plate 8).

White or pale yellow. Upf prominent black spot end cell ; apex dark brown more or less white spotted.

1 (2a). F costa plain. Below apex F and all H uniform dull green or greenish brown; unh costa with white spots and spot end cell. ♂ white; ♀ pale yellow. F v9 present.

**charlonia lucilla*, But. (35-45). The Lemon White. Baluchistan, Punjab. K.

2a (1). F costa black spotted. Above white, apex F spotted. Unf white bar mid costa continued across mid cell.

2 (3). Below apex F and all H with broad green regular stripes, leaving narrow white stripes between. F v9 present.

**belemia, Esp.* (40-50). The Striped White. Baluchistan. VR.

3 (2). Below apex F and all H with irregular open network of greenish brown lines, enclosing prominent pearly spots. F v9 absent.

**ausonia daphalis, M.* (40-45). The Pearl White. Chitral—Kumaon. R.

Note.—True *ausonia*, *Hub*, which has v9 present, is almost certain to be discovered in Baluchistan sooner or later.

B4. Pieris.—The Whites. (Plate 8).

F costa never spotted.

1a (6a). Upf prominent black spot end cell ; at apex ends veins black. Unh spot end cell not joined to costal spot.

1b (5). Upf and unf a more or less prominent discal costal black bar separate from the marginal spots ; in ♀ a black spot mid 1. Unf apex and all unh with more or less prominent green or yellow spots or bands.

1c (3a). Unh pale spot mid cell elongated.

1 (2). Unh veins crossing discal pale bands not green edged. F v10 from end cell ; vs 5 and 6 approximate.

chloridice, Hub. (45-50). The Lesser Bath White. Baluchistan—Chitral—Ladak. R.

2 (1). Unh veins throughout broadly green edged. F v10 just before end cell ; 5 nd 6 approximate.

**callidice kalora, M.* (50-60). The Lofty Bath White. Safed Koh—Chitral—Kumaon. C.

3a (1c). Unh pale spot mid cell circular. F v 10 from well before end cell ; 5 and 6 separate.

3 (4) Unh vein not prominently yellow.

**daplidice moorei, Rob.* (45-50). The Bath White. Baluchistan—Chitra and Murree. NR.

4 (3). Unh veins prominently yellow.

glauconome, Klug. (45-55). The Desert Bath White. Baluchistan—Punjab and Chitral. R.

5 (1b). Upf and unf no discal costal bar ; discal dark band in ♀ not above vein 4. ♂ upf prominent black spot mid 3 and traces of discal band below. Unh pale yellow, base costa orange and all veins very broadly black edged.

**dubernardi chumbiensis, El.* (45-60). The Chumbi White. Chumbi Valley. Sikkim. NR.

6a (1a). Upf no prominent black spot end cell ; unf always prominent black spot mid 1 and 3, of which both appear on upf in ♀ and usually only that in 3 in ♂.

6 (7, 8a). Unh more or less prominent broad irregular green or yellowish green discal band and similar basal area. Upf spot in 3 large and often joined to marginal dark area ; a triangular costal bar above the spot, usually joined to apical dark area above, but prominent below.

B4. Pieris.—The Whites. (Plate 8)—*contd.*

krueperi devta, DeN. (50-55). The Green Banded White. Baluchistan—Ladak. VR.

7 (6, 8a). Unh all veins prominently darkened, greenish.

α. Small and pale ; ♀ white.

napi ajaka, M. (40-55). The Greenvein White. Murree—Kumaon. C.

β. Larger ♀ yellow and often much darkened. Very variable.

napi montana, Ver. (50-60). Sikkim—Shan States. NR.

8a (6, 7). Unh unmarked beyond a more or less intense dusting of dark scales, which may be irregularly distributed.

8 (9a). Unh not dusted dark scales. Upf dcv black.

naganum, M. (65). The Naga White. Assam—N. Burma. VR.

9a (8). Unh dusted black scales. Upf dcv unmarked.

9b (11a). Uph with black spots at end veins. Upf inner edge of dark marginal area deeply scalloped.

9 (10). Unf with black marginal markings large. Above black margin continuous, cilia prominently broadly white. Unh uniform.

deota, DeN. (65). The Kashmir White. Kashmir—Ladak. VR.

10 (9). Unf no marginal black markings. Smaller. Upf black margin not continuous. Unh uniform.

α. Larger. More heavily marked.

canidia canis, Evans. (50-60). The Indian Cabbage White. Travancore—Nilgiris. VC.

β. Smaller. Less heavily marked, but very variable.

**canidia canidia, Sparr.* (45-60). Chitral—N. Burma. VC.

11a (9b). Uph no black marginal spots. Upf inner edge black apical area regular or very nearly so.

11 (12). Upf black apical area to v3 or 4. Large.

**brassicæ, L.* (65-75). The Large Cabbage White. Chitral—Assam and Plains adjoining Himalayas. VC.

12 (11). Upf black apical area only to v5 or 4. Smaller.

rapæ, L. (45-55). The Small Cabbage White. Baluchistan—Chitral and Ladak. VC.

B5. Aporia.—The Blackveins. (Plate 8).

1a (3a). Uph margin pale, veins crossing it white or narrowly black. Unh yellow with more or less complete sagittate discal line, which may be absent.

1 (2). Uph unmarked, no discal sagittate band. Above no suffusion dark scales.

α. Small. Upf postdiscal band complete and veins beyond towards apex prominently black, widening at termen. Unh darker, sagittate discal band prominent. Upf bar end cell variable, wider in ♀.

leucodice balucha, M. (40-50). The Baluchi Blackvein. Baluchistan—Chitral and Ladak. NR.

β. Large. H produced in middle. Upf postdiscal band usually obsolete in 3. Unh paler and discal band often absent.

**leucodice soracte, M.* (50-70). The Himalayan Blackvein. Kashmir—Kumaon. C.

2 (1). Uph prominent sagittate discal band. Below darker yellow.

α. ♂ above bright lemon yellow ; cell upf and below suffused black scales. ♀ white or pale yellow, no black scaling.

nabellica hesba, Evans. (50-60). The Dusky Blackvein. Chitral. VR.

β. ♂ pale yellow, ♀ white or nearly so, but densely suffused black scales up to the discal band on both wings, leaving only the margin and an area beyond the cell pale.

nabellica nabellica, Ersch. (50-65). Kashmir—Kumaon. R.

B5. Aporia.—The Blackveins. (Plate 8)—*contd.*

3a (1). Uph margin entirely dark or with nearly conjoined spots at ends veins.

3 (4). Above black, half of cell 1 F and 8 H white; prominent discal series white spots curved round cells; submarginal white spots between veins, elongated into double streaks in ♀. Unh alternate black and yellow streaks along margin.

larraldei harrietœ, DeN. (70-80). The Bhutan Blackvein. Bhutan. VR.

4 (3). Upf discal area white, with broad dark veins, nearly conjoined to a band on the disc, grading to an entirely dark form with white discal and postdiscal spots.

α. Palest form; discal and marginal bands not continuous.

agathon phryxe, Bdv. (80-90). The Great Blackvein. Kashmir—Mussoorie. NR.

β. Medium form; discal and marginal bands continuous.

**agathon caphusa, M.* Mussoorie—Kumaon. NR.

γ. Darkest form. Discal pale spots often small. Upf cell always black dusted.

agathon agathon, Gray. Nepal—Assam. R.

B6 Delias.—The Jezabels (Plate 8).

1a (4a). Uph and unh no prominent red or yellow spot at base.

1 (2a). Unh yellow, veins not black. Unf veins black. ♂ above white, apex F black, white spotted. ♀ upf black dusted and black veins; uph yellow.

α. ♂ upf black apex narrow, with large white spots. ♀ uph dark yellow with narrow dark margin. Unf white marginal spots not below v3; unh white spotted dark margin narrow, width=¼ length v4.

**agostina agostina, Hew.* (65-70). The Yellow Jezabel. Sikkim—Karens. NR.

β. ♂ upf black apex broad, spots blurred, small. ♀ uph paler. Unh white marginal spots to v1 or 2. Unh border=½ v4.

agostina agoranis, GRS. Dawnas—S. Burma. R.

2a (1). Unh yellow, veins black; prominent row marginal red spots. Above white, veins black on F in ♂, on F and H in ♀.

2 (3). Unh red marginal spots black bordered and a corresponding black postdiscal line uph.

**eucharis, Drury.* (70-80). The Common Jezabel. Ceylon, S. India—Kumaon—N. Burma. C.

3 (2). Unh red spots inwardly not black edged. Upf black discal band inclined, meets termen at v2.

α. Paler. ♂ apical dark area reduced. ♀ no dark scales between veins.

hyparete ethire, Doh. (70-80). The Painted Jezabel. Madras—Bengal. R

β. Darker. ♀ very variable; upf always much dusted black scales, often only leaving pale apical streaks.

hyparete hierte, Hub. Kumaon—Burma. C.

4a (1a). Unh or uph with prominent red or yellow basal markings.

4 (5a). Uph and unh prominent large yellow spot base 7. Black with more or less prominent white spots.

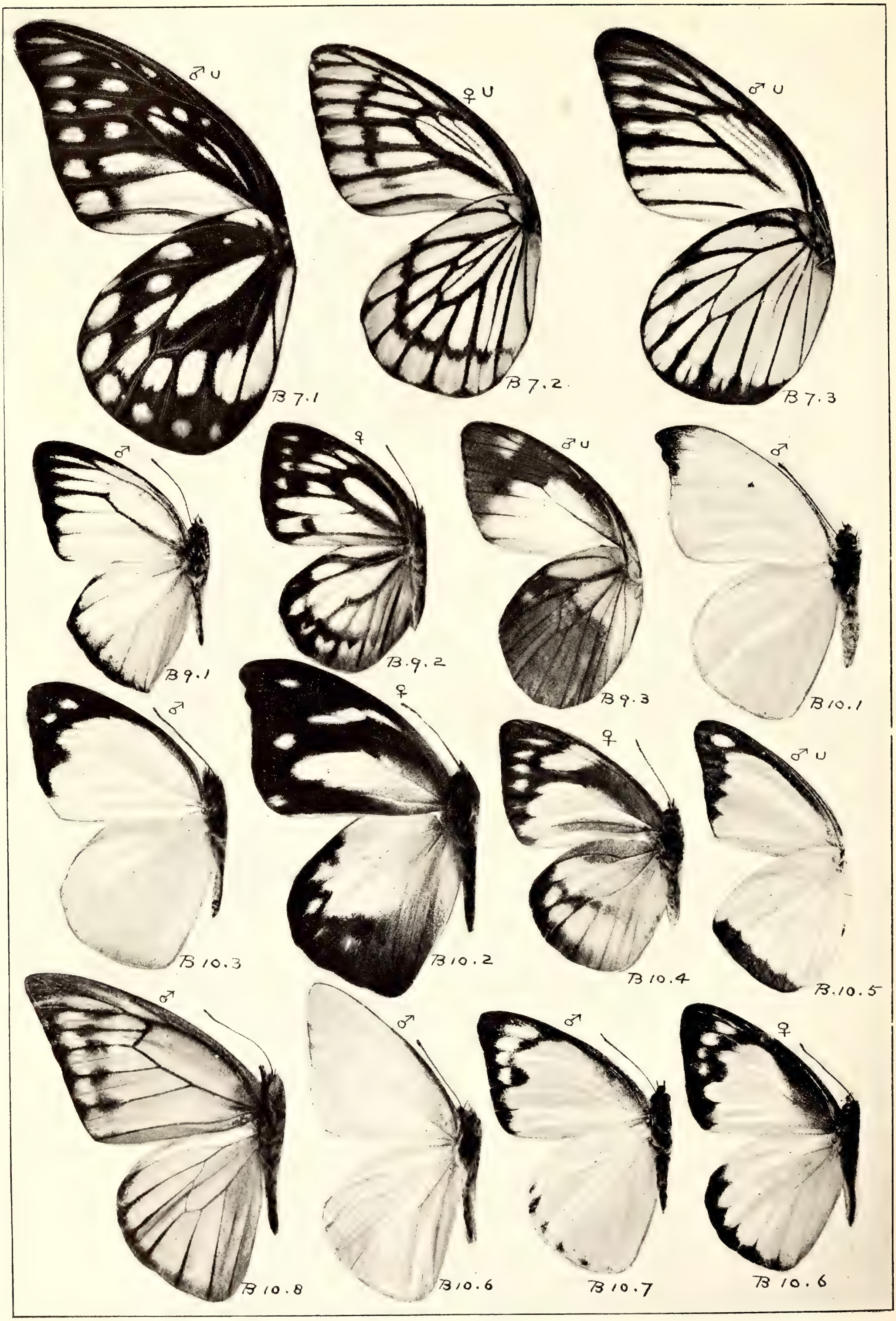
α. Uph prominent yellow tornal area joining a broad white discal band.

**belladonna belladonna, F.* (70-85). The Hill Jezabel. Kulu—Kumaon. NR.

v. sanaca, M. Upf whole of outer half is white and on upf there are broad white streaks. R.

β. Darker. Uph tornal yellow area reduced, not joining the white discal band, which is very narrow.

belladonna ithiela, But. Sikkim. NR.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♀ u
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B 10.6
♂
B 10.7
♀
B 10.6

B. **Pieridae.** 7. *Prioneris*: 8. *Huphina*: 9. *Appias.*

B6. Delias.—The Jezabels. (Plate 8)—*contd.*

γ. Larger and very dark. Uph no tornal yellow area.

belladonna berinda, M. Assam. NR.

δ. Smaller. As α but unh spots much reduced, spot in cell small.

belladonna perspicua, Fruh. N. Burma—Shan States. NR.

5a (4). Unh basal spot red, not yellow.

5 (6a). Unh red basal marking confined to a spot base 7. ♂ above dead white. ♀ upf black, white spot end cell and row post discal spots; veins may be broadly pale; uph white to yellow with more or less broad, white spotted, dark border. Below both sexes nearly as ♀ above.

**descombesi leucacantha, Fruh.* (80-85). The Redspot Jezabel. Sikkim—Burma. NR.

6a (5) Unh red basal marking extends from costa to dorsum.

6 (7). Uph no red basal colour. Upf pale spot end cell small, confined to base 4; inner edge pale submarginal streaks in line. Unh outer half cell yellow.

**aglaia, L.* (70-85). The Redbase Jezabel. Sikkim—Burma. NR.

7 (6). Uph prominent red basal area. Upf spot end cell very large; pale submarginal streak in 3 shifted in. Unh only extreme end cell yellow.

α. Paler and pale markings more extensive. Uph tornal area pale cream; unh pale area uniform, bright yellow.

thysbe kandha, Doh. (80-100). The Redbreast Jezabel. Madras. R.

β. Uph tornal area ochreous. Unh pale area tornally ochreous, apically white.

thysbe pyramus, Wall. Sikkim—Burma. NR.

B7. Prioneris.—The Sawtooths. (Plate 8).

1 (2a). Below no red markings. ♂ upf white with broad, white spotted black apex. ♀ as B6. 4, but has 4 prominent small white spots in an oblique curve towards end cell, which spots appear unf in ♂ and ♀. Unh black with yellow spots. DSF much smaller and unh almost all yellow.

**thestylis, Db.* (70-90). The Spotted Sawtooth. Mussoorie—Burma. NR.

2a (1). Unh yellow with red markings. Above white, all veins F and outer half H black.

2 (3). Unh prominent marginal row red spots, inwardly black bordered. Almost exactly as B6.2.

**sita, Fd.* (80-90). The painted Sawtooth. Ceylon, S. India. R.

3 (2). Unh white or yellow spots along margin; prominent red spot at base. ♀ upf veins broad black towards apex; uph postdiscal and submarginal dark band.

**clemanthe, Db.* (80-90). The Redspot Sawtooth. Sikkim—Burma. R.

B8. Anaphæis.—The Pioneers. (Plates 7).

Above white, black spot end cell, dark apex F and margin H. Unh yellow with black veins.

α. Above dark apex F and margin H very broad, obscurely white spotted in ♂, unspotted in ♀; costa above cell F dark. Unh dark orange.

mesentina taprobana, M. (40-55). The Pioneer. Ceylon. C.

β. Above dark apex F and margin H broadly white spotted (DSF more than WSF).

Unh bright yellow (WSF) to white (DSF); margin narrow and with large spots of the ground colour.

**mesentina mesentina, Cr.* All India except Assam. C.

B9 Huphina.—The Gulls. (Plate 8).

Above white, more or less black veined.

1a (3). Unf always black spot mid 3, separated from the black border by a white spot.

1 (2). Uph tornal area broad orange. Unh bright yellow with broad brown border and apex unf.

**lea, Db.* (40-55). The Orange Gull. Karens—S. Burma. C.

2 (1) Uph no tornal orange area.

α. Small. Upf black apex prominently white spotted, often yellow in WSF ♀.

nerissa evagete, Cr. (40-55). The Common Gull. Ceylon, S. India—Central Provinces and Bengal. C.

β. Large. Upf black apex practically unspotted, spotting never yellow. ♀ uph submarginal markings grey.

**nerissa phryne, F.* (50-65). Sikkim—Assam. C.

γ. Small. Upf black apex unspotted. Unh DSF white with broad grey veins. WSF unf basal half costal margin and unh costal and dorsal margin suffused bright yellow or greenish.

nerissa dapha, M. (50-60). Burma. C.

δ. Large. Upf margin unspotted. Unh mostly moss green with pale streaks between veins very narrow or absent.

nerissa lichenosa, M. (55-65). Andamans. C.

3 (1a). Unf no detached black spot mid 3.

α. Unh no pale streak in or beyond cell; WSF very dark green with broad dark brown discal area.

nadina cingala, M. (55-65). The Lesser Gull. Ceylon. R.

β. Unh paler; DSF pale yellow brown with darker discal areas; WSF base broad yellow, outer area dark brown.

**nadina remba, M.* S. India. *R.*

γ. Unh WSF long pale streak in cell and extending into bases 4 and 5; DSF very pale with brown dark veins. Upf dark apex narrower.

nadina nadina, Luc. Sikkim—Burma. NR.

δ. As γ, unh pale streak shorter, confined to end cell and bases 4 and 5.

nadina andamana, Swin. Andamans. NR.

B10. Appias.—The Puffins and Albatrosses. (Plate 8).

1a (6a). F upper apex cell right angled.

1b (4a). Unh always a tiny black spot at end cell and minute black spot on termen between veins.

1 (2a). Upf no white spots on the black apex; a black spot end cell and traces of a spot mid 3; in ♀ prominent spot mid 3 conjoined to apical black band. Uph ♀ black marginal spots. Apex F produced and margin crenulate below. ♂ no abdominal hair pencils, as in rest.

**lalassis, Grs.* (65-75). The Burmese Puffin. Karens—S. Burma. R.

2a (1). Upf always white markings on the black apex. Apex F produced, margin faintly crenulate below.

2 (3). Unf always large black spot end cell. Upf and unf large black spots mid 3, separated from dark margin by a white spot.

α. Upf ♂ black spot end cell separated from spot mid 3; ♀ continuous dark band from base cell absorbing spot end cell and mid 3; in DSF this band indicated.

**lalage lalage, Db.* (55-80). The Spot Puffin. Mussoorie—Tavoy. NR.

β. Upf ♂ with dark band as in ♀ of α.

alage lagela, M. Mergui—S. Burma. R.

B10. Appias.—The Puffins and Albatrosses. (Plate 8)—*contd.*

3 (2 . Unf no large black spot end cell. Upf and unf no detached spot mid 3.

α. Upf only two white spots on the black border. Unf ♂ black preapical band as wide as pale apex. ♀ uph only base 4 white.

**indra narendra, M.* (60-70). The Plain Puffin. Ceylon. R.

β. Paler below. ♂ uph no black terminal spots.

indra shiva, Swin. S. India. R.

γ. Upf DSF ♂ complete row apical white spots. Unf black preapical band =½ width pale apex. ♀ uph bases 4 and 3 white. Below much paler.

indra indra, M. Nepal—Burma. NR.

4 a (1b). Unh no small black spot end cell nor on termen between veins. F apex produced in ♂ ; termen never crenulate. In ♂ veins at apex upf black ; in ♀ cell all dark and joined to marginal dark band along 4.

4 (5). Unh no broad dark chocolate marginal area.

α. Small. ♂ upf veins only dark at margin and not inwardly edged by a dark band. Below white or pale yellow. ♀ upf no pale spots on the dark border.

libythea libythea, F. (50-60). The Striped Albatros. Ceylon, India. R.

β. Large. ♂ upf dark veins more extended at apex, inwardly bordered by a narrow dark band. WSF below pale yellow brown to white ; veins dark at apex unf as well as v8, mv and v7 unh, a narrow curved dark band through end cell beyond which all veins are dark. In DSF underside may be unmarked. ♀ upf prominent white spots on the dark border ; unh in WSF dark veins and band broad yellow.

**libythea zelmira, Cr.* (55-65). Bengal—Assam—Burma. R.

5 (4). Unh yellow, margin broadly dark chocolate. ♂ uph dark margin inwardly bluish edged. Unf prominent yellow apical spot on the dark margin. ♀ mostly blackish brown ; upf prominent white stripes in 1 and 2, 4 and 5 ; uph discal area whitish.

α. ♂ above dark margins very broad and inwardly very dentate.

lyncida taprobana, M. (55-70). The Chocolate Albatross. Ceylon. R.

β. ♂ above dark margin narrow and still inwardly dentate ; unh dark margin very broad, reaches end cell ; vs 6 and 7 prominently dark brown.

lyncida latifasciata, M. S. India. R.

γ. Above ♂ variable, margin hardly dentate on H. Unh dark margin very narrow. WSF large ; DSF small.

**lyncida hippoides, M.* Sikkim—Burma. C.

δ Paler. Unf apical spot on dark border white. ♀ uph outwardly greenish.

lyncida nicobarica, M. Nicobars. R.

6a (1a). F upper apex cell highly acute.

6b (8, 9) ♂ above white ; ♀ white or yellow, spotted black apex on upf.

6 (7). ♂ upf no postdiscal black spot in 3. Apex F pointed and termen straight. ♂ upf blackish scaling at apex and base very narrow or absent. ♀ always 5 apical spots ; unf inner edge dark apical area irregular, space 5 broadly pale at base.

α. ♀ typically white ; 2nd form yellow both sides. Smaller.

albina venusta, M. (55-70). The Common Albatross. Ceylon. NR.

♀ *v. flava, Rob.* NR.

β. ♀ always white above ; 2nd form yellow below. Larger.

**albina darada, Fd.* (60-75). S. India—Sikkim—Burma. Andamans. R.

♀ *v. semiflava, Rob.* R.

7 (6). ♂ upf except in α with a black spot in 3.

α. ♂ very like No. 6, but black scaling more extensive and may even enclose a black spot in 3; apex not so sharp and termen concave. ♀ not more than 3 spots on the dark apex; below typically white, but 2nd form is yellow with more

B10. Appias.—The Puffins and Albatrosses. (Plate 8)—*contd.*

or less distinct discal black spots unh; inner edge black apical area regularly curved and at most only just enters base 5.

melania paulina, Cr. (55 75). The Lesser Albatross. Ceylon. NR.

♀ *v. lankapura. M. NR.*

β. ♂ upf dark apex encloses 5 pale spots, costa black. ♀ as typical form of *α*.

melania wardii, M. S. India. R.

γ. ♂ as *β* but very variable; unf spot in 3 prominent, though rest of black apex may be absent. ♀ WSF as ♀ of *β*, but usually 4 spots on the black apex; DSF as ♂

melania adamsoni, M. Burma. NR.

δ. ♂ upf and unf unmarked except for black spot in 3, which may be obsolete above. ♀ as ♀ of *γ* and distinguished from ♀ of No. 6 *a* by space 5 being all dark unf.

* *melania galathea, Fd.* Andamans and Nicobars. NR.

8 (6a, 9). Above orange to deep crimson lake. ♂ upf with apex blackish and more or less prominent black spots between veins on disc. ♀ broad black margin F and H and irregular black discal band.

* *nero galba, Wall.* (65-80). The Orange Albatross. Sikkim—Burma. R.

8 (6a, 8). Above yellow; ♂ paler on F. ♂ upf termen and costa narrow black. ♀ broad dark terminal and costal margin F and termen H. Unh whitish. F v8 short in ♂, absent in ♀.

panda chrysea, Fruh. (50-60). The Nicobar Albatross. Nicobar. VR.

BII. Catopsilia.—The Emigrants. (Plate 9).

1a (4a). Below not closely striated with brown strigæ.

1b (3). Uph pale yellow or white. ♂ without, ♀ with, postdiscal dark band upf and spot end cell.

1 (2). Antennæ black. ♂ upf very narrow continuous black margin below apex and edge costa narrow black to base; below yellow, unmarked. ♀ very variable, but always with costa black from apex to base, usually conjoined to spot end cell.

**crocale, Cr.* (55-75). The Common Emigrant. Ceylon, India, Burma, Andamans. VC.

2 (1). Antennæ red. ♂ upf narrow black margin below apex macular and edge costa only black at apex; below greenish white with prominent red ringed silver spot end cell F and H and base 5 H. ♀ more sulphur yellow above, marginal band narrow and inner edge dentate; costa only black near apex; below often with large reddish purple blotches end cell F and above end cell H.

pomona, F. (55-80). The Lemon Emigrant. Ceylon, India, Burma, Andamans. VC.

♀ *v. catilla, Cr.* With purple blotches below. C.

3 (1b). Uph entirely orange. Below sulphur yellow.

**scylla, L.* (60-65). The Orange Emigrant. S. Burma. C.

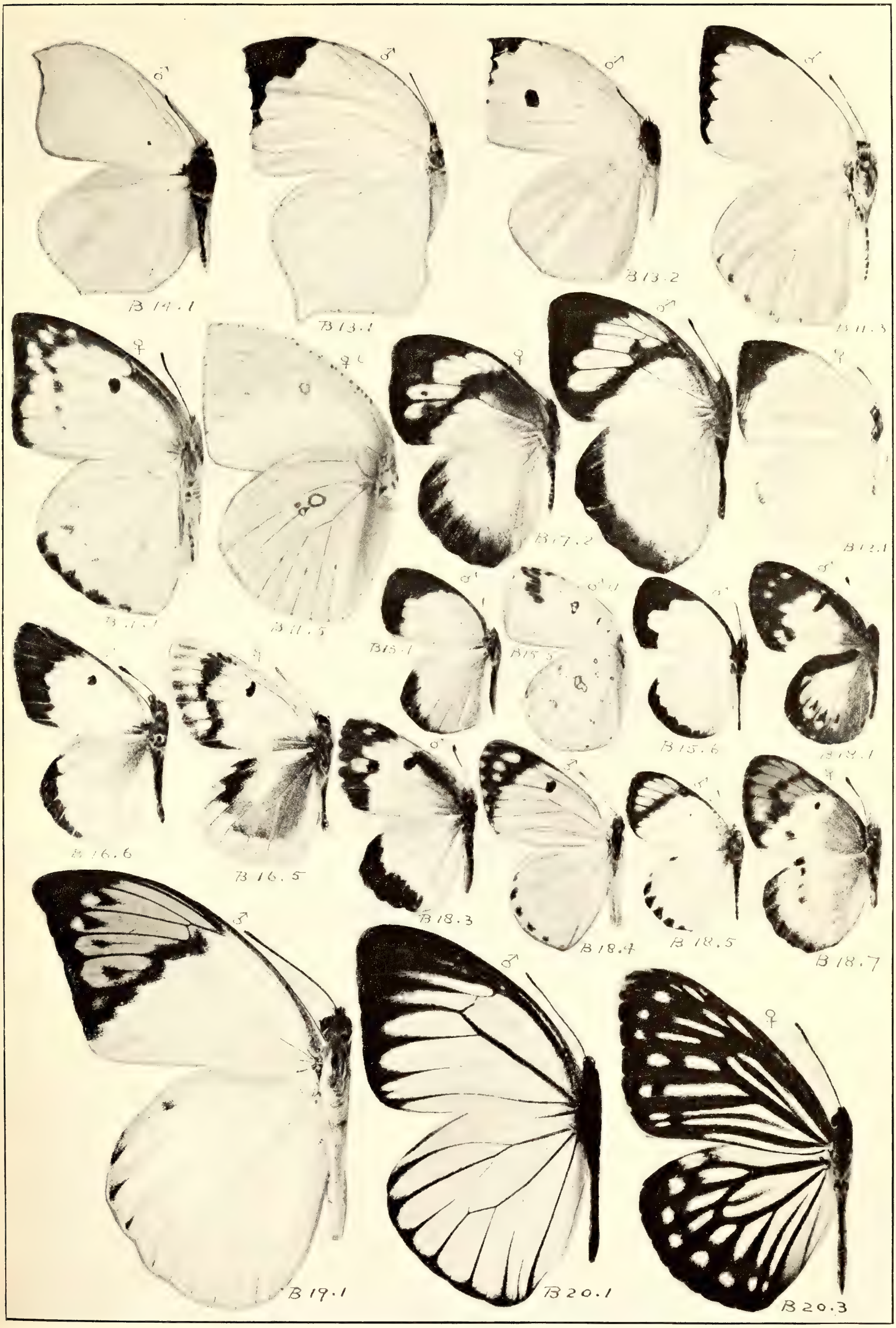
4a (1a). Below closely covered brown strigœ.

4 (5). Uph marginal dark border below apex continuous and often broad. Above greenish white.

pyranthe, L. (50-70). The Mottled Emigrant. Ceylon, India, Burma, Andamans. VC.

5 (4). Upf marginal dark border below apex macular, always narrow, some times brown. Above white.

* *florella, F.* (50-70). The African Emigrant. Ceylon, India, Burma, Andamans. C.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B 19.1
B 20.1
B 20.3

B. **Pieridae.** 11. *Catopsilia*: 12. *Gandaca*: 13. *Dercas*: 14. *Gonepteryx*: 15. *Terias*: 16. *Colias*: 17. *Ixias*: 18. *Colotis*: 19. *Hebomoia*: 20. *Pareronia*.

B12. Gandaca.—The Tree Yellow. (Plate 9).

♂ pale yellow; ♀ nearly white. Unmarked except for black apex and margin upf.

α. Upf dark margin narrow, not below v4 or 3.

harina assamica, M. (35-45). The Tree Yellow. Sikkim—Assam. NR.

β. Upf dark margin wider, to v3 or dorsum.

**harina burmana, M.* Burma. NR.

γ. Always larger. Border moderately broad.

harina andamana, M. Andamans. NR.

B13. Dercas.—The Sulphurs. (Plate 9).

1 (2). H angled at v4. Upf and unf large dark apical patch, extending below v 5.

α. Large. ♂ strongly crenulate at and below apex. ♀ pale yellow to white.

**verhueli doubledayi, M.* (60 70) The Tailed Sulphur. Sikkim—N. Burma NR.

β. Much smaller. ♂ termen not produced at apex and only slightly crenulate below. ♀ white.

verhueli gobrias, Hew. (50-60). Dawnas—S. Burma. R.

2 (1). H not angled at v4. F apical dark patch very small, not below v6 Upf prominent dark brown spot in 3.

**lycorias, Db.* (50-60.) Sikkim—Assam. R.

v. decipiens, DeN. Upf spot in 3 absent.

B14. Gonepteryx.—The Brimstones. (Plate 9).

1a (3). F. v6 nearer end cell than junction of 7 and 8; dcvs angled at their junction. Wings not crinkly. H termen not toothed at v4.

1 (2). ♂ above uniform sulphur yellow; ♀ creamy white. Uph orange spot end cell prominent and not dark edged. Below ♂ pale yellow green, ♀ greenish white.

rhamni nepalensis, Db. (60-70). The Common Brimstone. Chitral—Shan States. VC.

2 (1). ♂ above basal ½ F yellow, outer ½ and all H, except base white. ♀ chalky white. Above no spot end cell F, on H obscure brown. Below pale yellow, no green tinge; small discal brown spots prominent towards apex F and on H. H tooth at v3 twice as long as tooth at v2.

aspasia chitralensis, M. (55-60). The Chitral Brimstone. Chitral. R.

3 (1a). F v6 nearer junction 7 and 8 than end cell; 11 and 12 close; dcvs in line. Wings crinkled. H termen prominently toothed at v1, between 1 and 2, v2, long tooth at 3 and 4.

α. ♂ upf yellow, uph cream white. ♀ F and H cream white. Above orange spots end cells smaller and dark ringed, F costa concave in middle.

zaneka zaneka, M. (50-55). The Lesser Brimstone. Kashmir—Kumaon. NR.

β. ♂ above yellow, paler outwardly; ♀ pale yellow white. F costa straight.

zaneka zanekoides, DeN. S. Chin Hills. R.

B15. Terias.—The Grass Yellows. (Plate 9).

1a (4a). Below no ring spot end cells and no spots in cell F. Upf black border not continued along v1.

1 (2a). Unf 2 small spots end cell. No ♂ brand. Above black border F and H usually broad and inner edge regular.

****libythea, F.*** **(30-40). The Small Grass Yellow. Ceylon, India, Burma. VC.**

2a (1). Unf single small spot end cell. ♂ uph base 7 and unf base 1 a salmon brand.

2 (3) Upf marginal band reaches dorsum. Uph black margin to v1 or further. Apex F rounded.

B15. Terias.—The Grass Yellows. (Plate 9)—*contd.*

a. Always smaller.

venata venata, M. (30-40). The Spotless Grass Yellow. Ceylon, India. VC.

β. Always larger.

venata sikkima, M. (35-45). Sikkim—Burma. VC.

3 (2). Upf marginal band ends at v2. Uph dark margin consists of only 2 spots at apex. Apex F sharply angled, termen straight ; H apex produced.

laeta, Bdv. (35-45). The Short Bordered Grass Yellow. Ceylon, India. Burma. VC.

4a (1a). Below large irregular ring spot end cell F and H. ♂ unf narrow grey brand either side of mv from base to origin v2. Upf black margin always to tornus and continued along v1 ; except in DSF excavated between vs 2-4.

4b (7). Upf margin not continued along dorsum to base.

4 (5, 6). Unf 3 spots in cell. Unh usually spot extreme base 7.

a. Upf black margin always comparatively broad.

blanda silhetana, M. (40-50). The Three Spot Grass Yellow. Ceylon, India, Burma Andamans. C.

β. DSF margin very narrow, inwardly evenly curved.

blanda moorei, But. Nicobars. NR.

5 (4, 6). Unf 2 spots in cell, but one or even both may be absent. DSF with rusty spots below as in No. 4.

a. Generally smaller and yellower.

hecabe simulata, M. (40-50). The Common Grass Yellow. Ceylon, South India C. P. V.C.

β. DSF with very narrow margin upf.

hecabe fimbriata, Wall. Punjab—Chitral—Kumaon. VC.

γ. Generally larger.

hecabe hecabe, L. Bengal—Sikkim—Burma. VC.

h. DSF, particularly ♀ very much paler.

ecabe nicobariensis, Fd. Andamans—Nicobars. VC.

6 (5, 4). Unf a single zigzag spot in cell and a spot towards tornus in 1 Below not speckled with scattered black scales apart from the markings ; never with rusty spots ; unf apex always marked with brown; unh never a spot base 7 and often ring spot near base cell absent.

a. Unf apical dark area does not reach margin.

sari rotundalis, M. (40-45). The One Spot Grass Yellow. Ceylon—S. India. Sikkim-Karens. R.

β. Unf apical dark area as often as not reaches margin, forming a large apical patch.

**sari andersoni, M.* Dawnas—S. Burma. NR.

γ. Unf apex as in *a.* Upf inner edge of dark margin produced in 8 causing it to be at right angles to costa, instead of evenly curved.

sari andamana, Swin. Andamans, Nicobars. NR.

7 (4b). Upf black margin continued along dorsum to base. Unf no spots in cell and unh discal band in a regular line.

tilaha, Hors. (40-45). The Malay Grass Yellow. Mergui. VR.

B 16. Colias.—The Clouded Yellows. (Plate 9).

1a (7a). Above yellow, orange yellow or white.

1b (3a). Unh spot end cell white.

1 (2). Cilia and costa F and H white. Above ♂ pale greenish, with black veins ; ♀ white to pale greenish on F. Upf pale marginal spots complete, but spot in 3 smaller than rest. Uph spot end cell white ; traces of postdiscal and marginal dark band or spots. Unf decreasing discal black spots 1-3. Unh green, margin pale.

B16. Colias.—The Clouded Yellows. (Plate 9)—*contd.*

alpherakii chitralensis, Ver. (50-55). The Green Clouded Yellow. Chitral VR.

2 (1). Cilia and costa F and H pinkish, as in rest. Above orange yellow; margins in ♂ very broad, up to cell F, and are spotless; ♀ obscurely spotted in 2, 4 and 5; uph much darkened, prominent orange spot end cell. Unf decreasing discal spots 1-3. Unh uniform green, margin not paler.

wiskotti, Stg. (50-55). The broad bordered Clouded Yellow. Chitral. VR.

3a (1b). Unh spot end cell never entirely white.

3b (5a). Upf ♂ ♀ submarginal row pale spots complete, and all of equal size. Uph more or less complete postdiscal dark band. Unh red brown spot end cell.

3 (4). Uph no pale spot end cell and margin entirely pale. Above ♂ lemon yellow, ♀ yellowish white. Upf submarginal spots joined to margin. Unf complete postdiscal row dark spots. Unh greenish brown, broad pale yellow margin, inwardly bordered obscure dark spots on the dark area.

nastes thrasibulus, Fruh. (35-45). The Lemon Clouded Yellow Ladak. VR.

4 (3). Uph usually orange spot end cell and at least with blackish spots near apex. Above ♂ bright yelllow ♀ orange yellow. Upf yellow submarginal spots not joined to the margin. Unf discal black spots only in 1-3. Unh dark green margin broadly paler.

ladakensis, Fd. (45-50). The Ladak Clouded Yellow. Kashmir—Kumaon R.

5a (3b). Upf either no pale submarginal spots, or, if present, spot in 3 is smaller than rest or absent.

5 (6). Uph much darkened with complete postdiscal band and large yellow marginal spots separated by veins; prominent yellow spot end cell. ♂ ♀ upf dark border prominently spotted. Above ♂ clear yellow; ♀ orange yellow. Unh yellow green, margin broadly paler.

**berylla, Faw.* (45-55). The Everest Clouded Yellow. Chumbi Valley—Sikkim. R.

6 (5). Uph not darkened, postdiscal band and submarginal yellow spots not below v6, but the marginal dark band may be very broad and continuous; spot end cell orange. Unh yellow, more or less black dusted and with a discal row of brown spots.

a. ♂ upf dark apex broader, with pale spots small; above yellow. ♀ white, base F and all H dusky, border F as ♂

hyale nilagiriensis, Fd. (45-50). The Pale Clouded Yellow. S. India. C.

β. Very variable, ♀ typically yellow with margin upf spotted; ♂ typically as ♀.

**hyale hyale L.* (45-55). Baluchistan—Chitral—Kumaon. C.

♂ v. *erate, Esp.* Upf dark margin unspotted. NR.

♀ v. *pallida, Stg.* White. C.

v. chrysodona, Bdv. Orange yellow. Baluchistan—Chitral. R.

7a (1a). Above orange red or orange.

7b (10). Uph no brand in ♂.

7 (8a). ♂ ♀ with yellow spotted border. Above clear orange. Uph only discal area blackish. Upf marginal yellow spots conjoined to termen by narrow yellow lines. Unh green, prominent reddish spot end cell and discal row.

dubia, El. (40). The Dwarf Clouded Yellow. Chumbi Valley. VR.

8a (7). ♂ border unspotted.

8 (9). Small. Above clear orange. ♀ uph blackish, orange spot end cell prominent and elongated towards termen. Unh as No. 7.

a. ♂ black border above broad.

stoliczana stoliczana, M. (40). The Orange Clouded Yellow. Kashmir Ladak. NR.

B16. Colias.—The Clouded Yellows. (Plate 9)—*contd.*

μ. ♂ black border narrow. ♀ upf veins black; uph completely black except for orange spot end cell and marginal orange spots.

stoliczana miranda, Fruh. Chumbi Valley. VR.

9 (8). Large.

α Above fiery orange red. ♀ uph black, prominent orange red spot end cell and submarginal row yellow spots. Unh green, margin broadly yellow green.

eogene eogene, Fd. (45-55). The Fiery Clouded Yellow. Chitral—Kashmir. R.

♀ *v. cana, GG.* Above bluish white.

β. Above dark dusky orange, with small yellow submarginal spots in ♂. Unh bluish green; spot end cell small and mostly whitish.

eogene leechii, Groum. (40-50). Ladak. R.

10 (7b). Uph ♂ a yellow brand base 7. Above bright orange, ♂ border unspotted, ♀ yellow spotted. Unh greenish yellow; prominent double red edged silver spot end cell and discal row red spots.

α. Small. Paler, more orange yellow.

croceus croceus, Four. (45-50). The Dark Clouded Yellow. Baluchistan. VC.

♀ *v. helice, Hub.* Above whitish. R.

β. Small. Bright orange.

croceus edusina, But. (45-50). Chitral—Kumaon—N. Punjab. VC.

γ. Large. ♀ often orange pinkish.

croceus fieldii, Men. (45-65). Sikkim—N. Burma. C.

B17. Ixias.—The Indian Orange Tips. (Plate 9).

1 (2). Above white. ♂ ♀ upf apical band always orange.

α. ♂ preapical orange patch enters upper end cell and reaches below v2.

mariane marianne, Cr. (50-55). The White Orange Tip. Ceylon—S. India—Punjab and Kumaon. C.

β. Orange patch not into cell or below v2.

marianne nola, Swin. (45-50). Mahableshwar. NR.

2 (1). Above yellow; orange patch not below v2. ♀ may be white.

α Small. Upf base of 3 and half of 2 yellow. ♀ Yellow, band orange to yellow.

pyrene cingalensis, M. (50-60). The Yellow Orange Tip. Ceylon. C.

β. Similar. ♂ apical band broader and not angled in ♀.

pyrene frequens, But. S. India—Bengal. C.

γ. Small usually. Upf base 3 rarely yellow; half to two-thirds of 2 yellow. ♀ often white.

**pyrene pirenassa, Wall.* Punjab—United Provinces—Chitral—Kumaon. C.

δ. Often large, very variable. Upf orange enters lower end cell; base 3 never yellow and only extreme base 2. ♀ very variable sometimes nearly entirely suffused black scales on a white ground and the apical band white; or ground colour yellow and the band white.

pyrene rhexia, F. (55-70). Sikkim—Assam. C.

η. Smaller than last and more or less intermediate between last two. Orange colour not in lower edge cell. ♀ band yellow or orange and ground colour often white.

pyrene latifasciata, But. (50-60). N. Burma—Karens. C.

ξ. Much paler, lemon yellow. Orange area often clouded, presenting a dull frosted appearance. ♀ band always orange; cell F more or less black. Much more constant.

pyrene moulmeinensis, M. (50-60). Dawnas—S. Burma. C.

ε. As last, larger. Orange apex deeper and not so wide; often yellow spot base 3.

pyrene andamana, M. (55-65). Andamans. C.

B18. Colotis.—The Arabs. (Plate 9.)

1a (4a). Upf prominent dark spot end cell, which is always conjoined to the dark costal area extending to base. ♂ dorsum F more or less bowed.

1 (2a). Upf marginal dark band shifted in in 1, so as to enclose a large pale spot. Above salmon, margins broad black, spotted with the ground colour. ♂ uph costa broad black and the scales towards base 7 modified.

a. Upf semi-detached spot in 1 small, not quadrate ; pale spots on margin small.

**amata modesta, But.* (35-45). The Small Salmon Arab. Ceylon—S. India—Bengal. NR.

♀ *v. albina, Evans.* Above white. NR.

β. Upf semi-detached black spot in 1 large, quadrate ; pale spots on margin large.

amata amata, F. (35-50). Bombay—Sind—United Provinces. Punjab. NR.

2a (1). Upf dark margin regular to dorsum, bearing no pale spot below v3 F and H.

2 (3). Above salmon, black border bearing blueish spots at apex upf ; base F and dorsum H suffused blue grey. ♂ uph large salmon brand base 7 ; unf similar small patch near base 1.

protractus, But. (40-45). The Blue Spotted Arab. Cutch—Sind—Baluchistan—Punjab. NR.

3 (2). Above white ; black border upf shifted in in 3, enclosing large white spot. No ♂ brand.

**vestalis, But.* (40-50). The White Arab. Baluchistan—United Provinces. NR.

4a (1a). Upf dark spot end cell, if present, detached (except rarely ♀ of No. 4 *a.*) ; dark border only reaches dorsum narrowly or not at all.

4 (5a). Above salmon, ♀ may be white ; uph unmarked except for dark margin. Upf prominent spot end cell and dark apex with spots of the ground colour. ♂ unf prominent dark brown brand towards base 1, correlated to a nacreous area base costa uph.

a. Upf black apical area encloses 3 spots and reaches tornus. ♀ white.

**fausta fulvia, Wall.* (45-55). The Large Salmon Arab. Ceylon—S. India. NR.

β. Upf black apical area not enclosed at lower end and not to tornus. ♀ pale salmon.

fausta fausta, Oliv. Bombay—Baluchistan. Central India—Punjab. NR.

5a (4). Above white with orange or crimson apex (except sometimes ♀ of No. 6). No ♂ brand. ♀ uph more or less dark discal band, always indicated at costa.

5b (7). Upf apex orange and not marked with black spots in ♀.

5 (6). Upf apical orange patch inwardly dark edged ; in ♀ dark band upf decreasing evenly to tornus.

a. Upf black edging broader. Uph marginal spots conjoined to form a continuous band.

etrida limbata, But. (25-45). The Little Orange Tip. Ceylon. C.

β. Not so heavily marked.

**etrida etrida, Bdv.* S. India—Himalayas. Baluchistan. C.

6 (5). Upf ♂ inner edge apical orange patch not black edged, or, if so very faintly and a dark band shows through by transparency from unf on the orange area. ♀ upf very irregular postdiscal band from costa to v3, between which and the narrow dark margin are 4 pale orange or white contiguous spots.

eucharis, F. (40-45). The Plain Orange Tip. Ceylon—S. Central India. C.

7 (5b). Upf crimson tip, inwardly black edged. ♀ bases suffused blackish scales, apical patch crimson to pale red and bearing a dark postdiscal band on the crimson area.

B18. Colotis.—The Arabs. (Plate 9)—*contd.*

α. Dark edging to crimson tip broader and margin uph continuous black in WSF.

**danæ danæ, F.* (40-50). The Crimson Tip. Ceylon. S. India—Central Provinces. C.

β. Inner edging to crimson tip narrower; margin uph macular.

danæ dulcis, But. Sind.

B19. Hebomoia.—The Great Orange Tip. (Plate 9.)

Large. White. Upf broad orange tip, bearing postdiscal black spots; in ♀ black spots conjoined or nearly so, so as to leave a submarginal series of orange spots.

α. Inner black edging to orange apex obsolete.

glaucippe ceylonica, Fruh. (80-100). The Great Orange Tip. Ceylon. C.

β. Inner black edging to orange tip narrow.

glaucippe australis, But. S. India. C.

γ. Inner black edging to orange tip broad.

glaucippe glaucippe, L. Nepal—Burma. C.

δ. Inner black edging to orange tip obsolete. Above outer half H and lower discal area F pale yellow.

glaucippe roepstorfii, WM. Andamans. C.

B20. Pareronia.—The Wanderers. (Plate 9.)

♂ above blue with black borders. ♀ black with blue streaks between the veins.

1 (2a). Pale. Upf ♂ margin unspotted; no pale streak in 9; all veins not prominently black and uph mv no darker than scv. ♀ upf submarginal spots and outer ends discal streaks in line; no streak in 9; uph submarginal spot in 6 and dscal streak conjoined.

α. DSF small; WSF large. ♂ uph border narrow.

**aviatar avatar, M.* (60-90). The Pale Wanderer. Sikkim—N. Burma. R.

β. Small. ♂ uph border wide. ♀ pale streaks wider, streak in 1 joins lower submarginal spot in 1.

avatar paravatar, DeN. (60-70). S. Burma. R.

2a (1). ♂ darker; nearly always pale streak in 9; all veins prominently black; uph mv much wider black than scv and bearing modified scales, in line with v6, which is also very wide, as also is v6 usually. ♀ upf submarginal spot and discal streak in 3 shifted in ; always streak in 9, which with streaks in 4, 5 and 6 form an oblique row. Uph submarginal spot and discal streak in 6 separate.

2 (3). ♂ above margins usually unspotted; if spotted, spots very small and not increasing to apex; WSF much rounder. ♀ usually bluer, submarginal spots smaller; uph submarginal spot in 7 prominently larger than rest.

α. ♂ upf no prominent white spot at apex.

ceylanica ceylanica, Fd. (65-80). The Dark Wanderer. Ceylon—S. India. NR.

β. ♂ upf always small white spot at apex. ♀ whiter.

ceylanica naraka, M. Andamans. NR.

3 (2). ♂ upf margins prominently spotted and spots increasing to apex. ♀ whiter, marginal spots prominent; cilia much whiter and upf apex paler.

valeria hippia, F. (65-80). The Common Wanderer. India—Burma. C.

♀ *v. philomela, F.* Uph discal area yellow. R.

(*to be continued.*)

REVIEWS.

FAUNA OF BRITISH INDIA, BIRDS, Vol. I (2nd Edition).

BY

E. C. STUART BAKER, Esq., O.B.E., M.B.O.U., F.L.S., ETC.

[The issue of the first volume of the new edition of the Fauna of British India is of great importance to all ornithologists in India. We are very glad to be able to give in this number two independent reviews of the book by two ornithologists of very considerable experience. Editors.]

I

There is one outstanding characteristic of Indian Ornithology which cannot but fail to strike its devotees however superficial their studies, and that is the manner into which its history and progress is divided into well marked periods. That this should be so is perhaps inevitable in a country isolated from the main centres of world progress and where the study of modern sciences is not indigenous but is dependent for its whole being on a small alien community drawing its inspiration from Western sources.

This community is composed entirely of people who are compelled to earn their living in various ways and who study the sciences in their spare time for their private satisfaction, almost invariably far from the reference museums and libraries which modern science finds indispensable. It is therefore for the most part inevitable that they should be unable to do much original research work and keep closely in touch with the incessant change and growth that is a feature of the present day in scientific circles. They are accordingly, to a degree unknown in other countries, dependent on their local text-books, and each successive text-book of importance as it is published becomes first of all an active stimulus to work and then, as it grows out of date but still remains the guide of all local workers who follow it in ignorance of later developments in the rest of the world, finally something of a hindrance to progress.

Three main stages of this nature in the history of Indian Ornithology occur to us; the first is the publication of Jerdon's "Birds of India"; the second is the period of extreme activity which centred round the labours of Hume and which but for the dishonesty of a servant would have culminated in the publication of a monumental history of the Birds of the Indian Empire; the loss of this work can never be sufficiently deplored by all who are acquainted with the genius and the industry of the greatest of Indian Ornithologists. The third period was marked by the publication at long intervals of the four volumes of Birds, in the Fauna of British India series, published under the authority of the Secretary of State for India. The affectionate usage of Indian naturalists has been to speak of this work as "Blanford and Oates."

The four volumes of Blanford and Oates appeared in the years 1889-1898 and with their appearance they immediately became the standard work on Indian Ornithology. Unfortunately their publication coincided with the fairly general adoption by European naturalists of the trinomial system of scientific nomenclature and this standard work because almost at the moment of its birth out of date, being based on the binomial system. The result has been that the admirers of the work, and they are many and grateful, have had their admiration tinged with regret that it should not ave been exempt from the common fate of all Indian books on Ornithology, hamely, that the measure of its success should be the measure of the harm n it has done to Indian Ornithology by divorcing it from the current progress of the science.

Fortunately at this juncture the Secretary of State for India has been pleased to sanction a fresh edition of the work ; a new edition was needed in any case as the first edition has been long out of print and is now difficult and expensive to procure ; and in the volume before us an attempt has been made to utilise the popularity of the first edition and by incorporating in it the progress of the last quarter of a century to remove the reproach that "Blanford and Oates" had become, like its predecessors, a hindrance to Indian Ornithology.

There is no need to introduce to readers of this Journal, Mr. Stuart Baker who has been selected by the general Editor of the "Fauna of British India" to prepare this second edition. By reputation and attainments he was obviously marked out in advance for the task and he is to be congratulated on the energy and speed with which he has produced the first volume. The succeeding volumes are promised to appear at intervals of about two years and they will be anxiously awaited by all naturalists in the East.

The volume now before us reproduces very closely the format of the first edition, both in binding, arrangement of the text, and in the employment of the majority of the same text figures. A new feature is however introduced by the insertion of 8 coloured plates. These are reproduced from paintings of birds by the author, but we are constrained to say that the paintings are not up to the standard required in a work of this nature and hardly deserve the encomium passed on them by the general Editor (Professor Shipley) in his introduction.

This volume, dated July 1922, contains about 500 pages and treats of 476 species and subspecies, and few new forms are described. Owing however to the inclusion of several species which do not appear in the first edition, and to the division of most species into subspecies, which were not recognised or treated separately in the former edition, this volume does not cover as much ground as Oates' first volume and the new edition will inevitably run to greater bulk than its predecessor.

It is not proposed here to treat of certain changes in classification and nomenclature that Mr. Stuart Baker has made. Critics will be found to complain of changes made and changes neglected, but these matters are so largely dependent on personal opinion that to discuss them here would be out of place. Mistakes too may be found in the work, but that was inevitable. It is not however in our opinion the province of the reviewer to point out mistakes or matters in which his opinion differs from that of the author ; such discussions should appear as separate papers, so as to give the author an opportunity of answering the points, and we hope that the addenda and corrigenda which prove to be necessary will be included in the second volume when it appears, rather than delayed for the completion of the work. *Bis dat qui cito dat.* For the main ground of our gratitude to Mr. Stuart Baker is that he has brought Indian Ornithology up to date and into touch with general Ornithology and given us all firm ground from which to restart our labours. It was becoming an impossible task for the Ornithologist in India to keep touch with all the scattered notes and papers concerning Indian birds when his text book was too out of date for annotation.

Mr. Stuart Baker with the permission of the General Editor has introduced one very important difference in this edition from its predecessor. The Synonomy has been reduced to merely a reference to the original description and a reference to Blanford and Oates. The change will be deplored by many and it is certainly a serious blemish in the usefulness of the book though we are grateful for the insertion of type localities after the most modern practice. But it is difficult to see how the publication of the work could have been effected in the present state of the trade without some drastic cut of this kind. The descriptions of plumages have been also curtailed, in our opinion less defensibly ; for the scientific ornithologist (for whom this work is primarily intended) certainly needs *more than has here been given* of the seasonal changes and different stages in dress caused by age and sex, while the subject of down plumages has been entirely omitted. This brevity is certainly one of the serious defects in the work.

These cuts have been made, in the claim of the author, to allow of more space being devoted to the modification and habits of each form. In these features the work is an improvement on its predecessor but perhaps an undue proportion of the space has been occupied by the breeding habits of a bird ; here as elsewhere in his writings Mr. Stuart Baker scarcely pays sufficient attention to migration which is undoubtedly one of the most important elements in a study of birds.

It is in no carping spirit that we have pointed out the features in which in our opinion the book falls short of perfection. The main fact remains that Mr. Stuart Baker is to be warmly congratulated on the issue of this useful volume, and Ornithologists generally are to be congratulated on its addition to their library. To Ornithologists in India it will be indispensable.

II.

A little over thirty-three years ago the first volume on Birds in the Fauna of British India was published, and it is now naturally somewhat out of date.

All interested in Indian birds were therefore delighted to learn, a year or so ago, that a new edition of this indispensable work had been sanctioned, and that its preparation had been intrusted to Mr. E. C. Stuart Baker, our leading authority on Indian ornithology.

In the introduction to the first volume of the original series, Dr. Blanford remarked that the number of birds to be described in the three volumes, the original number sanctioned, exceed those in Jerdons "Birds of India" by more than one-half. This was to a great extent accounted for by the territorial limits of the latter's work, and although the new edition of the "Fauna" deals with practically the same area as the old, it would appear as if there would be a similar increase in the present volumes.

The cause of this increase is two fold, in the first place a very considerable number of new birds have been described from within the confines of the Indian Empire during the last thirty years, and secondly, birds are now studied more exactly and intensively, so that small differences in size and colour are considered sufficient for distinguishing the various racial forms or subspecies. Many birds which Oates considered as one species, have now been divided into several subspecies, and also, a number of birds, which he thought were good species, have been reduced to subspecific rank.

In the present volume Mr. Baker describes 476 forms as against 556 in the corresponding volume of the old edition, but he only deals with the Passeres up to the end of the *Trogolodytidæ* (wrens), included by Oates in the *Certhidæ* and also considerably reduces the *Timaliidæ*.

It is unfortunate that the synonomy has had to be omitted, but probably that could not be helped for want of space. Perhaps the Secretary for State may see his way, when Mr. Stuart Baker has completed the work, to sanction a final volume bringing the nomenclature and synonomy of each species up to date.

The arrangement under each species is much the same as before, with the exception that the headings of the paragraphs are in heavier type, and additional headings have been added, such as colour of soft parts, measurements and nidification (previously included under "Habits"). Under this last heading full particulars are given of the size and colour of eggs, type and situation of nest, time of laying and in fact everything known about the breeding habits of the species. In these paragraphs Mr. Baker is at his best and has collected together a large amount of information much of which has not been published before, which probably makes this the best part of the book.

The paragraphs on "Distribution" however are not up to this high standard and it seems a pity that more details, especially of rare occurrences have not been given. The range too of many species is stated in rather a vague way. We should like to add that when the Presidency of Bombay or Madras is meant, the word Presidency, or abbreviated Pres. should always be added as Bombay or Madras alone stands for the towns of these names.

The systematic index at the beginning of the book is arranged differently to before and the change seems unfortunate as it is neither as clear or easy to read.

In regard to the forms recognised, the author has erred distinctly on the liberal side and future revisions we are convinced will show that a considerable number of races cannot stand.

There are many inevitable changes in nomenclature and we are glad Mr. Baker is so sanguine that the present names, with a few exceptions, "will be permanent.' The revision of the names of Indian Birds has unfortunately just begun and it will be a long time until anything like finality is reached.

A new innovation, and one which it must be admitted will be very useful to many, is the addition of eight coloured plates to the new edition. These illustrations are not however up to the standard we are accustomed to in the Journal and few will agree with the Editor of the series that they are living "drawings."

The arrangement and treatment of the various families is somewhat different to that of Oates. As before, the present volume begins with the crows or *Corvidæ*, but from it the subfamilies of the Tits and Parrot-bills have been taken away. These follow as families, the *Paridæ* and *Paradoxornithidæ*, but surely if the last is to include the genus *Panurus* it will be known by another name! Next come the Nuthatches or *Sittidæ* followed by the *Timaliidæ*, the *Crateropodidæ* of Oates, which has been very considerably altered by the taking away and placing elsewhere the bulbuls, the shortwings and various individual birds such as the Blue Bird, *Irena puella*, the Sultan bird, *Melanochlora sultanea*, the Spotted-wing *Psaroglossa spiloptera*, etc. All these changes are a great improvement. The Bulbuls, now given family rank as the *Pycnonotidæ*, come next in order, followed by the Tree Creepers, *Certhidæ*, minus the wrens, (*Troglodytidæ*) which are included in a family by themselves along with *Tesia* and complete the volume.

It is to be hoped that ornithologists in India will send into the Journal any notes, additions or omissions in the present work and we are sure Mr. Baker will be only too pleased to receive such assistance which perhaps might be incorporated in an appendix in the final volume.

The great difficulty in revising a book such as the present volume is to keep it within the prescribed limits and it is easy to criticise omissions often the difficulty must be to compress all the information available. We shall look forward to the future volumes and we hope Mr. Stuart Baker will see his way to take notice of one or two of our remarks.

THE PRESERVATION OF SHIKAR TROPHIES.

We have received from Messrs. Van Ingen and Van Ingen, the well-known taxidermists, a copy of their pamphlet on "The Preservation of Shikar Trophies." We strongly advise all sportsmen to possess themselves of this admirable little book before setting out on their next shooting trip. The novice can learn from it how to supervise intelligently the all important processes of skinning and initial preparation of his trophies, and will thus be saved much anxiety lest his first spoils of the chase be ruined by wrong treatment,—a thing which only too frequently happens if one has to leave everything to Native Shikaris whose methods are, to say the least, generally crude and unscientific. And we venture to think that even the old campaigner may pick up a hint or two from the book that he will be glad of when at last he brings to bag the ten-foot tiger or the "father of all sambar" of his dreams.

The processes described in the book are simple and easily understood and are well illustrated by numerous photographs and diagrams. The writers are thoroughly well qualified by a wide and varied experience to write with authority on their subject.

Copies of the pamphlet may be had gratis on application to Messrs. Van Ingen and Van Ingen, Mysore.

OBITUARY.

Dr. HENRY NEVILLE COLTART.

Born 4th October 1873. *Died 25th May* 1922.

It is with the greatest regret that we have to announce the death of Dr. H. N. Coltart who passed away at Epsom in May 1922.

Dr. Coltart came to India in 1899, being appointed Medical Officer to the Makum Tea Company whose estates lie in the extreme North-East corner of the Lakkimpur district of Assam. Immediately on his arrival he began to study the local avifauna, so extraordinarily rich and varied in Eastern Assam, a work for which his appointment and position gave him exceptional facilities.

His house was situated on the boundary of the more open, tea-clad foot hills and plains, whilst behind it rose the densely forested Naga Hills to a height of 7,000 to 8,000 feet. As a doctor he soon came into contact with the Trans-Dikhu and other tribes of Nagas, and his patience, constant kindness and unwearying attention to their illnesses and complaints earned him their respect and admiration, and it was through them that he first obtained many of his greatest rarities.

It was in this way he obtained his earliest specimens of Godwin-Austen's Hornbill, then only known from those obtained by that gentleman and by Dr. Hartert. Later, however, he procured a grand series of adults of both sexes, as also young and eggs from the forests in the vicinity of Makum. The rare Laughing Thrush, *Dryonastes nuchalis*, he discovered breeding in the nullas and ravines within a stone's throw of his dispensary and he was the first also to discover the breeding habits and eggs of many other birds such as *Schœniparus rufigularis, Dicæum trigonostigma, Heteroxenicus sinensis,* etc. Amongst the birds he collected in Assam were *Stachyris nigriceps coltarti* and *Alcedo asiatica coltarti,* named by Dr. Hartert and myself after their discoverer.

In 1900 he left Assam for an appointment in Behar where he continued to do good ornithological work, though in that very thoroughly worked district, the home of Inglis and others, he was naturally unable to discover any further novelties either amongst birds or their eggs.

In 1913 he returned to England and joined his father's practice at Epsom, but in 1917 he met with a motor accident and lost his right eye. His sight, which was then already shewing symptoms of failing, grew gradually worse and before his death he was practically quite blind from atrophy of the nerves. Typical of the man's extraordinary vitality and pluck was his acceptance of, and endurance during, the accident. After it occurred he drove himself to the nearest doctor and that night his eye was taken out; seven days later he was back at work performing a delicate operation.

Dr. Coltart had always been a great athlete, excelling at all games. In 1898-9 his hurdling was well up to championship form, whilst he was first class at all sprinting up to the ¼ mile. He played a good game at tennis and a more than good game at hockey and both rugby and soccer football, whilst at polo he captained innumerable teams to victory. At this last game he had the knack of getting a first class game out of second or third class ponies, for the most contrary animals would do their best for him after a very few rides.

As a man it may be said of him that there have been few who have inspired such universal affection; wherever he went he at once became a favourite as well as a leader and his death at the early age of 48 leaves very wide circle of friends who will mourn his loss in many countries.

H. J. ELWES, F.R.S.

Mr. H. J. Elwes, who died on November 26th, 1922, at the age of 76, was the son of the late J. H. Elwes of Colesborne, Gloucestershire. He was educated at Eton and afterwards on the Continent, finally entering the Scots Guards, from which he retired after a few years with the rank of Captain. On leaving the army he settled at Preston near Cirencester, but on the death of his father he removed to Colesborne, where he continued to reside till his death. In 1869 he began his travels with an expedition to S. E. Europe in company with T. E. Buckley, the ornithological results of which were described in a joint paper in the *Ibis* for 1870. In the following year he went to India principally with the object of collecting birds, and while trying to make arrangements at Darjeeling for a trip into the interior of Native Sikkim, he met Dr. W. T. Blanford, who also had the same object in view. The two joined forces and the necessary permission obtained they set out in the second week of August, and in the course of a three months' tour visited a large part of North and Eastern Sikkim. Though unsuccessful in their attempts to penetrate into Tibet, they added considerably to the Geography of Eastern Sikkim exploring the Lachan Valley as far as the Kongra Lama Pass and up the Lachan Valley to the Donkia La, while they visited the Cho-La and discovered the now well known Jelepla Pass, but at that time unknown to Europeans and not marked on any map. Considerable collections were brought back and the mammals and birds were reported on by Blanford in a paper in the Jour. As. Soc. Bengal (Vol. XL, pt. 2, pp. 367-420, Vol. XLI, pt. 2. pp. 30-78). Besides adding considerably to the knowledge of the avifauna of Sikkim, two new species were discovered, one of which, a shore-lark, was procured on the Kongra Lama Pass by Elwes and named after him *Otocoris elwesii.* During the remainder of his stay in India, Elwes did a certain amount of collecting in many parts of the country including the Punjab, U. P., C. P., Bengal, Lower Assam, the Carnatic and Travancore, where he hunted elephants in the Cardamom Hills and in a letter to the *Ibis* (1870) described the more important birds he met with when so employed. After his return to England he published an important paper on the distribution of Asiatic Birds in the Proc. Zool. Soc. (1873) and that together with a monograph on the genus *Henicurus* and a description of a new *Crossoptilon* from Tibet may be considered his chief contributions to ornithological literature.

While on his first visit to Sikkim he was much struck with the wonderful butterflies of that country and began to make a collection, which he handed over to his brother-in-law Mr. F. Du Came Godman. From the date of this visit Elwes may have been said to have turned his attention to Entomology and we find him back in Sikkim after butterflies in the cold weather of 1876 and again in 1880-81, in company with Mr. Godman. These visits did not add much to his knowledge, since they were at the wrong season of the year, but they enabled him to get in touch with several well known Collectors as O. Muller and Messrs. Knyvett, Mandelli and Gammie and through them enrich his collections. With the assistance of the two last named, native Collectors were sent to the interior of Sikkim and over the frontiers of Tibet and Bhutan.

In 1886 Elwes was appointed naturalist to the British Mission to Lhassa under Mr. Colman Macaulay. The mission was delayed in starting and after never leaving Darjeeling was finally abandoned altogether. Elwes, however, had not been idle and employed his time from May to August in collecting hard in British Sikkim and in addition to capturing large numbers of specimens obtained a first hand knowledge of them in the field. With all these materials and experience he published in the Trans. Entom. Sc. (1888, pp. 269-465) a long and valuable paper on the Lepidoptera of Sikkim, in which 530 species of butterflies were recorded. A number of other papers and monographs were published by him at different times, but the Sikkim paper and his monograph on the Oriental Hesperidæ, in which he was asisted by his Secretary Mr. T. Edwards, are the two he is best known by to Indian workers. He was a most generous donor of lepidoptera to the Natural History Museum at South Kensington, presenting his collection of Holarctic butterflies and also other collections, which he purchased.

In Botany as well as sylviculture and gardening Elwes was much interested and in his many trips abroad, collected seeds and plants, when opportunity arose. He published a monograph of the genus Lilimui in 1880 and later in collaboration with Prof. A. Henry he brought out a magnificent work on the Trees of Great Britain and Ireland (1906-1913). Laterly he took a leading part in the resuscitation of that old and important publication the Botanical Magazine. In his garden at Colesborne were wonderful collections of plants, many of which he had brought back from his entomological excursions to Canada, the States, Mexico, Andes of Peru, Japan, Formosa, the Altai Mts. and many parts of Europe.

His last visit to India was in 1913, when in Company with the late Mr. A. Trevor Battye he went, among other places, to Katmandu. One of the principal objects of this visit was to obtain information and specimens of the different breeds of domestic sheep, which at that time he was engaged in studying with Prof. Cossar Ewart of Edinburgh.

He was elected a Fellow of the Royal Society in 1897 and was Vice-President and Victoria Medalist of the Royal Horticultural Society as well as President of the Royal Arborical Society. In 1893 and 1894 he was President of the Entomological Society of London and at the time of his death President of the British Ornithologists Union.

Elwes was a tall handsome man of extraordinary energy and up till quite recently could give a good account of himself in a long day on the hill side or in the low ground after partridges.

In 1871 he married Margaret, daughter of W. C. Lowndes-Stone of Brightwell Park, Oxon, by whom he had a son, Lt.-Col. H. C. Elwes, D.S.O., M.V.O., and a daughter Mrs. E. C. Treplin.

THE PASSING OF AN OLD SHIKARI.

Members of the Society who have visited or resided in Bhuj will learn with regret that the old Bhil shikari, Ookha, died on the 22nd March 1922. He must have been over 60 years old and had worked as shikari for some 40 years, first with the officers of regiments stationed here and later with the Political Agent. He was a fine old shikari and a mine of really sound information on birds and common mammals. He was Captain C. D. Lester's shikari and egg collector when that officer revised Palin's Birds of Cutch and is frequently referred to in that book as 'my shikari Ookha Bhil.' During the cold weather of 1920-21 he was able to go out shooting with me, but he had a severe bout of fever last monsoon and the cold weather brought on asthma and cough. It nearly broke the old man's heart that he was unable to go out with me this season. I saw him in his hut in the Bhilwada the day before he died, and though he was able to talk it was obvious he could not last long. The following morning he passed quietly and painlessly away to those happy hunting grounds which, we hope, are reserved for all good shikaris.

E. O'BRIEN,
Lieut.-Colonel.

BHUJ, CUTCH,
27th March 1922.

THE FINANCIAL POSITION OF THE SOCIETY.

HONORARY TREASURER'S REPORT.

Leaving out of consideration for the moment Receipts and Expenditure on account of the Mammal Survey and Prince of Wales Museum, we find our receipts for 1922 were about Rs. 8,000 less than for 1921. This is almost entirely accounted for by the difference in Life-membership subscriptions. On the raising of the amount of the Life Members' subscription in 1921, we received Rs. 11,609-8-0 whereas this year at the higher rate we have only received Rs. 2,923-8-0, a difference of about Rs. 8,000.

We lost last year our Government Grant of Rs. 15,000 but we gained in sales of journals, game books, interest on investments, etc., about Rs. 15,800.

Current subscriptions have remained almost unaltered.

Our expenditure was some Rs. 15,562 less than in 1921. This is made up by a drop in salaries of Rs. 13,046-10-11, owing to the Prince of Wales' Museum now paying 50 per cent. of the salaries of certain of those employed by the Society, and by one or two smaller items of expenditure.

The position is, however, not a very satisfactory one, as our income from sales of books, charts, etc., is not a permanent income and should be earmarked for paying off printing and other charges which are still outstanding. We still owe Messrs. Bale and Sons some Rs. 26,600 for the game books and towards this we have about Rs. 48,000 worth of stock in hand which will probably take some years to realise.

The increase in cost in printing the Journal in 1922 was Rs. 2,510 more than 1921, which was Rs. 7,436 more than in 1920. It is to be hoped that in 1923 the cost of the Journal may be reduced to the 1921 figure.

At the close of the year 1922 the number of Members on the books were :—Life Members 157 and Ordinary Members 1,280. During 1922, 144 Members resigned, 79 Members joined and 2 rejoined.

Prince of Wales' Museum.

Except so far as the staff is concerned the financial position of the Natural History Section of the Museum does not appear to be in a good position. It has a grant from Government of Rs. 17,500 which, I understand, may be increased to Rs. 19,000, and last year received interest from investments, etc., amounting to Rs. 1,000. Expenditure on standing charges will consist of :—Salaries Rs. 15,500 and sundries Rs. 1,000, which should give it a balance of about Rs. 2,500 a year for maintenance expenses. But as regards provision for exhibits, we have at present housed only the mammals at a cost of Rs. 22,000 and it is estimated that as much again will be required to complete the bird and reptile galleries, whereas the available cash resources at present are under Rupees ten thousand. Unless very considerable financial help is speedily forthcoming there is little hope of being able to give the public of India the full benefit of the magnificent collections the Society can place in the Museum.

Mammal Fund.

On 31st December 1922 this fund had a balance of Rs. 21,700. During the past year we received Rs. 5,600 in donations and the second half of the Government of India Grant, *viz.*, Rs. 22,500. The Government Grant has now ceased and unless we receive donations no further income can be looked for for this account. Salaries however will be considerably less this year as we only have Mr. Wells and Baptista working for us.

It is unlikely that fresh funds will be forthcoming and we must rely in future on work done for us—as has been done in the past, by honorary workers. The need for the Mammal Survey still exists—especially in the Eastern Ghats and parts of Burma, but looking back on what has been effected we may well be proud of what the Society's Mammal Collectors have accomplished.

T. A. M. HILL,
Honorary Treasurer.

NOTE BY THE HONORARY SECRETARY.

The position, as the Honorary Treasurer says, is not over satisfactory. The payments for Life Membership should go to Capital and not be treated as revenue and, as the Honorary Treasurer points out, the amount received on account of sale of the Game Books has to be remitted to the printers. 144 *Members resigned against* 81 *who joined.* A few more years like last year will write "finis" to the History of this Society. Yet all that is needed is for the members themselves to help the Society by getting new members so that future reports will read "150 *new members joined and only* 50—owing to unavoidable causes—*resigned*". A form of application for membership is inserted in this Journal.

R. A. SPENCE,
Honorary Secretary.

MISCELLANEOUS NOTES.

No. I.—SOME NATURAL HISTORY NOTES CONNECTED WITH THE PRINCE OF WALES' TOUR IN INDIA.

The Forestry of Nepal.

In the first part of my account of H. R. H. The Prince of Wales' Shoots in India, when dealing with Nepal it had been my intention to include some notes on the wonderful forestry of the country. The following extract from a note entitled 'A Royal Shooting Ground' which appeared in the "Field" vividly depicts the calm and twilit grandeur of these gigantic forests.

" The tangle of valleys at the foot of the giant Himalayan ranges is covered with dense vegetation of a thousand different forms. The higher lying tracts consist for the most part of virgin *sal* forest, the tall, straight boles, crowded together, stretching upward for light and air from a sea of undergrowth. In the hollows and damper stretches, creepers cling about the trees and in the forest glooming one is aware of a silent struggle for existence among these vegetable things. One sees great forest trees, killed and rotting, held up in constrictor-like coils or caught in tangled webs of living rope, a fight between the nobler forest forms and parasitic growths. The fight even goes on between members of the predatory, creeping tribes themselves. Mingled with the varied odours of living green things there hangs a faint ever-present acrid smell of decaying vegetation. Elsewhere one finds wide acres of " narkat," half grass, half weed, of stupendous height, tunnelled by the fauna of the forest, but otherwise more impenetrable even than the tree jungle. The forest is, indeed, rather like a great city, but peopled by plants of many races and diverse habits ; with congested areas where struggling multitudes toil, its spacious residences of sylvan aristocrats, its river ways, streets and parks. In the stifling overgrown forest, men can only walk by the few well-defined forest paths ; wandering off these they are swallowed up, blind, and lost."

Elephant Machans.

During the late Royal tour in India I had an opportunity of observing the habits of very many elephants in the different Indian States. Concerning those I saw in Nepal I have already made some notes on page 691, Volume XXVIII, No. 3 of the Journal. I add now a note on the huge machan erected in the midst of the Camp at Biknathori, and aptly termed a " Funk Machan ", a description of which has already been given. Luckily during the Prince's visit, it never had to be made use of for the purpose for which it was erected. But it made an excellent look out place. Fresh tracks of wild elephants had been seen on the actual camping ground just before the tents were erected, and so it was considered advisable to have a place of refuge prepared in case they invaded the camp at night. General Kaiser of Nepal told me that this " Funk Machan " had its origin in its prototype in the camp of the Great Jung who used to camp in the heart of the elephant country for Keddah purposes.

Similar machans, or screened platforms, were erected for spectators to view the final drive in the Keddah operations on the Royal visit to Kararpur Camp, Mysore, but they had more than one storey.

Curious antipathy of elephants to mile stones.

Among my field notes in my diary I come across the following :—

" When motoring from Mysore to the Shooting Camp at Kharapur I noticed along the road sides the mile stones and road gauges. At the beginning the first twenty miles they were all marked white with black figures, the last part of the journey however they were exactly *vice versa*. Someone told me that the latter mile stones and road gauges are marked thus on account of their being in elephant jungle, and that elephants have a curious antipathy to the former mile stones and uproot them always, but in the latter case they tolerate them. I took photos of these mile stones and wrote to Mr. Theobald who replied :—

"You are quite right about the mile stones being painted black, as it has been found that if painted white, elephants uproot them. I do not think it is due to any bad trait but to mischief. Even the wooden railings are painted black for this reason. White seems to catch the eye of elephants and they apparently cannot resist playing with them."

Colonel T. J. McGann of Mysore confirms this. He has been a considerable number of years in the State and says "It seems evident that elephants dislike the white coloured mile stones and displace them and do not mind the dark coloured ones.

Mr. P. F. Bowring, the Commissioner in Mysore, also wrote to me saying :—

"I have heard the same thing about the elephants objecting to white mile posts and not objecting to black ones, or rather, if they happen to be white ones, they pull them up. Muttannah, the late Conservator of Forests, declared it was so."

Sambhar in Bhopal.

One of the sambhar shot in Bhopal had a large body and ill developed horns. Whether this was due to overshooting resulting in the destruction of the best stock, or due to an excess of does and consequent weakening of the stock it is difficult to decide.

Col. R. W. Burton writes as follows to me. "I do not recollect that the question you raise has ever been thoroughly investigated. Horns of ruminants vary much according to the locality in which the animals are found. In the Satpura Hills, Tapti Valley, and that part of the country, sambhar carry very large and perfect horns : in parts of Central India, Orchha and Panna States in particular, abnormal heads are very common, and many of them at the same time run fairly large. In the Himalayan Terai jungles, sambhar carry smaller heads, anything approaching 40″ being quite unusual. It is, I think, generally agreed that abnormalities in horns of ruminants, those classes of them which periodically shed their horns, are caused by injuries during the time the horns are in velvet, that is to say, in process of formation and growth. Such abnormalities would not be inherited, unless perhaps they were caused by bodily injury. In such a case it may be conjectured whether the abnormality could not be transmitted. Possibly it could. But the question you raise as to the causation of the heads of sambhar in Bhopal being so frequently small and ill developed is apart from that of abnormalities, and I think we must look for the reason either in heredity : brought about by some peculiarity in the country, its soil, or the climate, causing a poor growth of horn ; or in the other two causes you mention.

It may be that the Bhopal sambhar are very much in bred. Perhaps those jungles are isolated and the stock of sambhar get no infusion of blood from other localities. Or it may be that there is a weakening of stock brought about by shooting off of too many stags. Sambhar go back in their heads when past their prime, so, if there is much shooting done in the place you mention, it is quite possible that, a large number of the best stags having been shot off, mostly immature ones remain. They may not have had time to attain full age and corresponding growth of horn and this would affect the stock.

It would, I think, require a knowledge of that part of the country extending over some years, and a considerable amount of observation extending over the same period, to enable anyone to come to a sound conclusion in the matter."

Vultures that live for centuries.

I am indebted to Sir H. Perry Robinson, K.B.E., for permission to publish the following :—

"Some thirty-five miles from Madras, out Chinglepet way, with a good motoring road to take you there, is the holy hill of Tirukalikunram. There is a great temple down below, a place of immemorial sanctity, but the hill, with a second temple perched like some Rhine-castle on its very summit, is more famous, and what chiefly makes it famous is its sacred birds. Every guide-book or other authority tells you that the birds are "kites," but they are not—or were not yesterday—but are vultures, the familiar black and dirty white, yellow-billed, unsavoury Egyptian vulture, or Pharaoh's chicken.

They are immortal birds; or have, at least, now been living for some centuries. More remarkable still is it that they travel every day a thousand miles or so to spend half an hour here at Tirukalikunram, coming just for their midday meal. They breakfast in Benares eight hundred miles or so to the north. They come here, stop for their luncheon and pass on—some say to Ceylon to roost, though others believe that they spend the night at Delhi. This is their daily routine and has been for centuries : or so tradition says and so the pious believe. The facts that I can vouch for are as follows :

Every morning pilgrims, many of them from far distant places, gather here and climb the hill ; and a very arduous climb it is, up steep stone steps. The European who is not sound of wind and limb had best avail himself of the luxury of a chair and be carried by four men to the summit, four men who grunt in unison at every laborious step and stream with perspiration long before the top is reached. Close beside the temple which crowns the hill, but a few feet lower, is an immense smooth rock on which the priest, who feeds the sacred birds, takes his station, early in the morning.

There are two priests who take the task in daily alternation. The one who officiated yesterday was a youngish man—perhaps thirty years of age—magnificently built, with great shoulders and brawny neck. He sits alone cross-legged on the bare smooth rock, naked to the waist save for rosaries round his neck, surrounded with a paraphernalia of half a dozen brass plates and *lotas.* Sitting there, silhouetted against the blue sky, with the sun beating on his brown neck and back, his head bowed in an attitude reminiscent of the Buddha, his fingers fumbling with his beads, his lips moving unceasingly in silent prayer, he makes an extraordinarily striking figure. Close by, but lower, where a thatched shelter gives shade from the sun, the pilgrims sit silent, almost motionless, patiently awaiting the coming of the birds.

So we waited without a sound, except as now and again the priest shifted his *lotas* which scraped and tinkled on the stone ; and time passed. Now and again a common kite sailed by, looked down curiously, and passed on. Eleven o'clock—a quarter past eleven—half past—when suddenly two shadows moved across the rock ; and a moment later, from nowhere, out of the blue, two vultures dropped upon the rock some ten yards from where the priest was sitting. He moved his vessels round towards them and held one out to the visitors at arm's length. Slowly, walking very clumsily on the slippery stone, they waddled towards him. One, however, yesterday had evidently done himself well in Benares and had no appetite for lunch. He watched from the background while his partner gorged himself, first from the dishes, then from the hand of the priest, who kneaded with his fingers great balls of foodstuffs and thrust them into the vulture's mouth.

Two things are curious about this ceremony. In the first place, the food which is given the birds is not such as vultures ordinarily prey upon, being a pasty mass of rice and wheat and sugar and butter *ghee.* But the birds are, or one was yesterday, greedy enough for it. In the second place, when a man sits day after day in the same spot with food it is not remarkable that here Egyptian vultures—which are not uncommon birds—should learn to come and be fed. What is remarkable is that only two should come and not 200 or 2,000, as well as kites and crows and other kinds of vultures : two only, coming always, it is said, from the same quarter of the sky and taking flight again in the same, but another, direction. And, according to tradition, it has always been two century after century, no other birds venturing to approach the holy feeding ground.

The birds have fed and flown again, the pilgrims rise and troop down that long hill once more, satisfied, however far they may have come ; for have they not seen plainly with their own eyes the miraculous event which is famous all over India ? It is very curious but I wish the sacred visitors were some less abhorrent fowls than the loathly vultures. They should be birds of paradise at least."

BERNARD C. ELLISON, C.M.Z.S., F.R.G.S.

No. II.—ON THE RANN OF CUTCH.

(*With two Plates*).

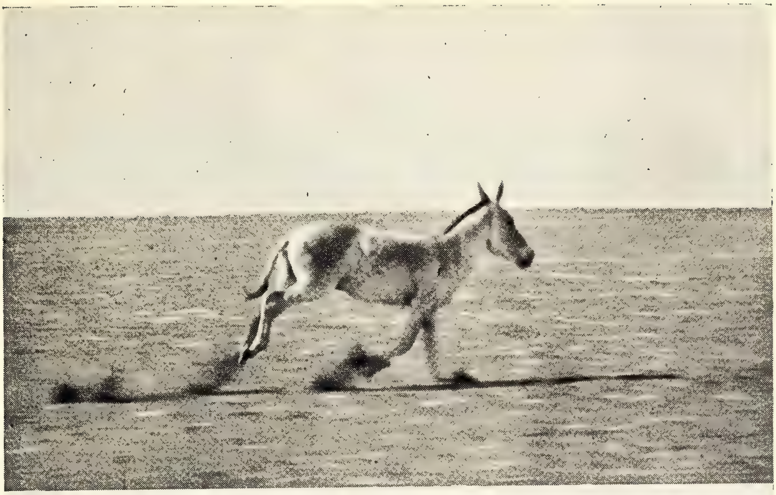
(I) Blackbuck and Motor-Car.

Separating Cutch from Kathiawar lies the Rann of Cutch, to most people but a name on the map of India. Towards its eastern end, once the monsoon is well over and its tides receded, it ceases to be impassable to a foot passenger, and by the middle of the cold weather presents a dry flat surface over which a motor can travel at speed for miles in any direction. Where the State of Dhrangadhra borders the southern edge of the Rann, it is the habit of herds of blackbuck, after spending the night in the cultivated lands, to betake themselves to the open Rann during part of the day. To His Highness the Maharajah of Dhrangadhra, a keen shikari and keener motorist, this fact naturally affords a unique opportunity of combining two favourite pursuits.

To the sportsman it may seem to savour of not playing the game to compel an animal to pit its speed and powers of endurance, subject to the limitations of flesh and blood, against a machine. But all depends upon how it is done. In Vol. XXVIII, No. 2 of this Journal, Capt. Pitman refers, in his Notes on Mesopotamian Mammals, to the hunting of gazelles in similar fashion on the Samarra plain, and rightly condemns a practice, in which some, apparently, indulged, of pumping lead into a herd. The method he complained of was to wear an animal down and shoot it at a few yards' range, which must sometimes have meant a fairly long chase but was doubtless justifiable when meat was needed or, perhaps, to secure an exceptional head.

His experience on the Dhrangadhra Rann has shown Sir Ghanshayamsinhji the fairest method, to impose a strict limit both on the number of shots fired at an individual beast and on the time expended in chasing him. With but three cartridges allowed, and a time limit of five minutes, the odds are by no means heavily against the buck. Good though the going usually is, no car at high speed can maintain a level motion, so that anything like a real aim is impossible, while, even with the quickest of snapshots, the slightest bump is enough to throw your muzzle off the line of aim at the moment of pressing the trigger.

My own experience the first time that I tried the game was probably neither better nor worse than the average. Three times did I expend my three shots on a blackbuck without success and then let him go while I sought another. It was only at my fourth attempt that I succeeded with the second shot at a distance of about fifty yards. The antelope, for five minutes at any rate, could I found maintain without difficulty a speed equal to the best a Ford could achieve. One could easily enough get up to within from thirty to fifty yards as a rule, but it was only when the buck indulged in their characteristic practice of crossing in front that a nearer shot occasionally offered. Of course by this method the animal is less likely to be killed outright than if ridden down till exhausted and shot at very close range, as described by Capt. Pitman, but on the other hand it has, in the former case, a fair chance of escape altogether, as I have shown.



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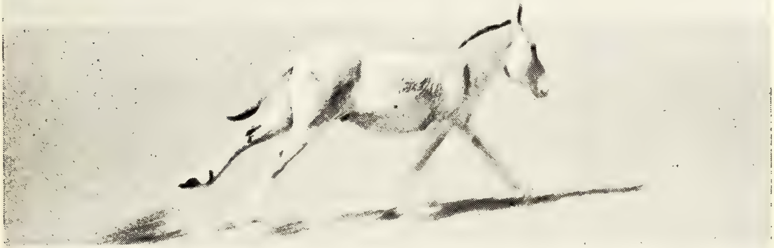

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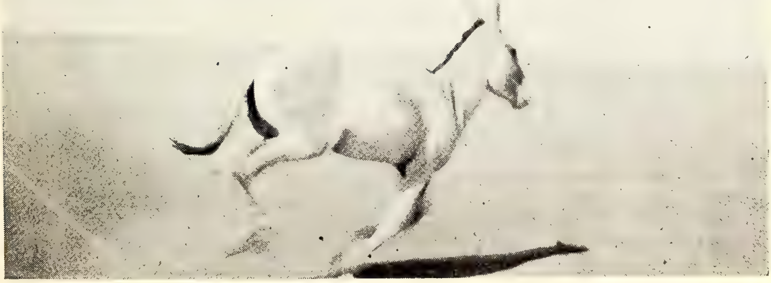
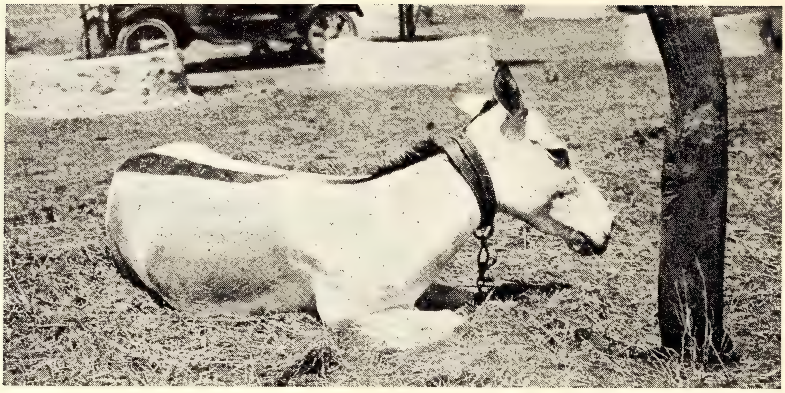
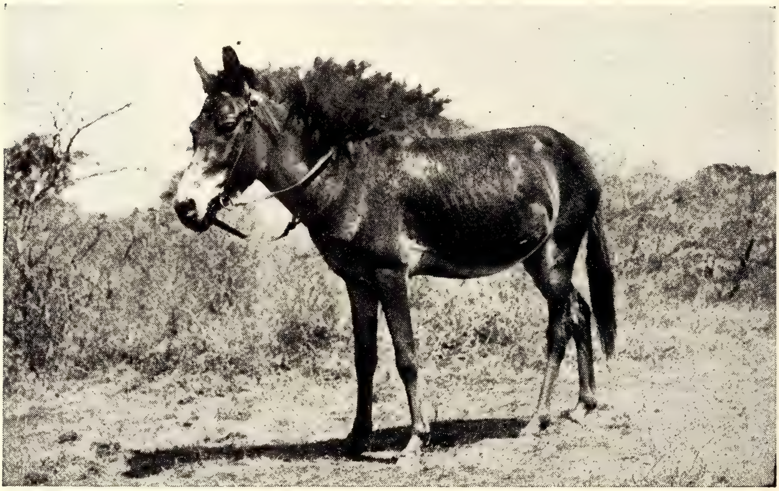


3

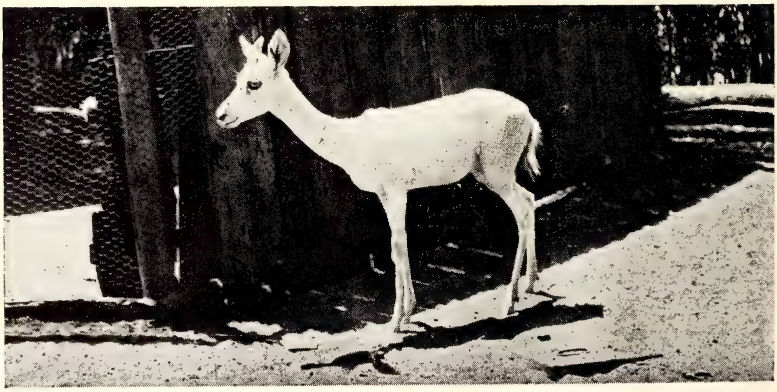
THE WILD ASS (*EQUUS HEMIONUS*) ON THE RANN OF CUTCH.
(Photos taken from a motor-car by Mr. C. A. H. Edwards.)



CAPTIVE MARE OF WILD ASS.



HYBRID COLT OF WILD ASS MARE—SIRED BY BAY COUNTRY-BRED PONY.



ALBINO CHINKARA.

As to the speed attained: full speed on the Rann in my own Ford meant 35 to 36 miles per hour. In one instance a young buck fairly ran away from my car travelling at this pace, and must have been doing not less than 38 at the end of eight minutes, which I tried as an experiment, without firing after a third miss and letting him go. H. H. the Maharajah assured me that on one occasion, he was driving, I think, an Overland car, when a buck was shot by Mr. C.A.H. Edwards of the P.W.D. who was with him, the speedometer showed 42 m. p.h.! The buck was broadside on, going as fast as the car, and when shot dead fell and slid with its own momentum a distance of 27 measured yards from the spot; of course the surface cannot have been very dry at the time. Mr. Edwards confirmed the correctness of these figures.

(II) The Wild Ass (*Equus hemionus*).

The Rann of Cutch is well known as the permanent habitation of the Asiatic Wild Ass, whose comparatively close acquaintance in the wild state a Ford car has enabled me to make. In February last I took a friend, with my wife, out on the Rann to shoot a blackbuck. On our way back, close to the southern shore, the mirage on the sky-line showed a number of weird figures which presently resolved themselves into a little herd of the Rann donkeys which I had been most anxious to see but had not come across before. They were able to attain a very useful pace, but could not compete with the car, though on our near approach they jinked away with no lack of agility. We were late and had no time to spare but had a good look at them for two or three minutes at a distance of about a dozen yards. What struck me very much at first sight was the parti-coloured effect produced by the alternating patches of white and light reddish-grey which composed their colouring, reminding one of the Noah's Ark animals of one's childhood, and quite unlike the uniform style of coating of the Somali Wild Ass.

I longed for a camera but had none with me. On a subsequent occasion, however, I did succeed in taking some fairly good snapshots of a donkey from my car, but I was not as successful as Mr. Edwards who has very kindly permitted me to make use of some better ones taken by himself in similar conditions. I enclose three of these interesting and probably unique photographs; one at least of them should reproduce well.

I also send photos taken by myself of a captive mare of the Wild Ass, now in the possession of H. H. the Maharajah of Dhrangadhra, and of a two-year old hybrid colt of hers, sired by a bay country-bred pony. This interesting youngster is smaller than the mother, of a uniform bright brown colour. As to the pace of the Wild Ass I may mention that on the open Rann I found them able to attain and keep up without difficulty a speed of 26 miles per hour.

A White Chinkara (*Gazella bennetti.*)

Though it has nothing to do with the Rann, it may be of interest to mention here, an albino chinkara doe in possession of His Highness, which was found as a week-old fawn near Dharangadhra last year. Of it also I enclose a photograph.

A. H. MOSSE,
Wadhwan, *October* 1922. Major, I.A.

No. III.—SOME NOTES ON THE COMMON INDIAN OTTER (*LUTRA LUTRA*).

(*With a photo.*)

It may be of interest mentioning a few facts in connection with the food and habits of this animal.

According to Blanford, the Common Indian Otter inhabits nearly the whole of India and Ceylon and also occurs east of the Bay of Bengal.

The otter which I am writing about, and of which I also give a photograph, was caught in the Pamber River, Kodaikanal, S. India, at an elevation of 7,000 ft. He came to a meat bait; the meat was that of a Jerdon's Civet, (*P. jerdoni*) which still had the odour of the animal about it.

After having skinned the animal, I examined the stomach to see what it had been feeding on. The main part of the contents of the organ was that of decayed wood and crabs. In addition to the above mentioned, there was a quantity of green leaves (which I was unable to identify owing to their being partially digested), plus some other material.

As there were hardly any fish and not many crabs in the stream I suppose it took to eating the wood in order to still its hunger or may be for some other unseen reason.

What nourishment the otter derived from this diet is hard to say; but nevertheless the animal was in a very good condition. As regards the food, Blanford writes as follows:—"They live chiefly upon fish, crustacea and frogs, and as is well known, when they find food plentiful, kill far more than they require to eat." These animals also occur in the Kodai Lake. They have been known to attack ducks when on the water and even dogs while swimming. The presence of otters in a stream or lake may be easily detected, as the animals usually come out of the water and deposit their excreta on rocks in the stream or on the banks. If not disturbed they generally come to the same place every time, except perhaps when on their way up or down stream.

Bombay Natural History Society, C. McCANN.
15th January 1923.

No. IV.—TIGER CLIMBING A TREE.

At Hungpru in Mergui District, three Karen elephant catchers had a machan 50 ft. above ground in the fork of a fairly high tree. Five feet below the machan the tree forked. There was a bamboo ladder leaning up against the tree by which they used to ascend. The ladder met the tree 10 feet above ground and was tied to the tree (right up against it) for a further 35 feet, *i.e.*, up to the fork. At 4 a.m. the Karens were awakened by the tree swaying, being dark they could see nothing but heard some animal breathing in the fork below them which they thought was a bear. By shaking the machan they were able to shake the beast off the fork, and heard it clawing while sliding down the tree till it stuck the ground where it roared and then made off. The same morning at 10 a.m. the Karens came to my camp and told me the above tale. I went out and saw the tree and noticed the following:—The tree was heavily scratched from the fork downwards for 35 feet down to where the ladder first met the tree, the scratches were long, deep, claw marks, nothing like those made by a bear when coming down, and were placed alternately on either side of the tree as if the animal had swung during its descent. At the foot of the tree were two bamboo stumps with sharp tops, these tops were covered with blood for about 5 inches and were split, the interstices being full of red and white hair. The elephant path leading away from the machan bore the pugs of a large tiger coming towards and going away from the tree. The ground near the foot of the tree had been torn up with deep scratches. Out of the last lot of scratches on the tree I cut a claw which had been wrenched off.

The width of the ladder was about 14″. I found it very difficult getting to the fork of the tree up this ladder as it was absolutely perpendicular.

The above incident took place at Hungpru in the Bokpyin Township, Mergui District, on the 8th March this year.

I am sorry I was unable to get a photograph of the tree as it was in dense jungle and the snaps I took turned out failures.

MAYMYO, UPPER BURMA, G. E. R. COOPER.
3rd October 1922.

[Several instances of tigers climbing trees have been recorded in the Society's Journal. *Vide* Mr. G. Monteath's note, Vol. XXVI., No. 3, p. 837 and Brig.-General P. Burton's notes in Vol. XXVII., No. 2, p. 164; Ibid. No. 3, p. 383—EDITORS.]

No. V.—SUPPOSED OCCURRENCE OF THE ERMINE IN INDIA.

In Vol. XXVII, page 624 of this Journal, Mr. C. H. Donald, writing from Dharmsala, reported having captured a young male of what he takes to be the Ermine (*Putorius erminea*). The animal was obtained on the Larka Pass at 13,000 feet elevation.

This summer, while camping out on the Pir Panjal Range not far from Gulmarg, I got two specimens of a small stoat or weasel which from Mr. Donald's description must have been identical with his animal. They were shot among loose rocks at about 12,000 feet elevation. One on August 9 and the second on September 4. In colouration my animals agreed entirely with Mr. Donald's, and in fearlessness also I can confirm his experience.

From the key to the *Mustelinæ* in the Fauna of British India I decided, as did Mr. Donald, that my specimens could only be the Ermine. I sent a skin and skull to the Curator of the Bombay Natural History Society who kindly forwarded them to the British Museum, whence Mr. Oldfield Thomas writes as follows :—

"Osmaston's *Putorius erminea* is *Mustela whiteheadi.* It is interesting to record the fresh locality........"

SRINAGAR, KASHMIR. B. B. OSMASTON, I.F.S.

No. VI.—THE OCCURRENCE OF THE MALLARD (*ANAS PLATYRHYNCHA*) IN RAJPUTANA.

To the best of my recollection, in Hume and Marshall's Game Birds of India, the Mallard is spoken of as a somewhat rare visitor to Rajputana, while Mr. Stuart Baker records that it has been "occasionally" shot there. My experience last cold weather leads me to believe that, some years at least, it is not uncommon. I was stationed last cold weather at Nasirabad early in December, and at a place called Barli about 25 miles S. of Nasirabad, I shot one Mallard, a female; later in the same month Major G. G. Dormer of the 104th (Wellesley's) Rifles, with whom I was shooting, shot three, one a male and two females. These three were shot on two different days on different tanks close to Sareri some 40 miles S. of Nasirabad. At about the same time three more were shot by another officer of the Regiment, who was shooting still further south with another party in the neighbourhood of Hamirgarh.

THAL, N.W.F.P., R. H. STABLES.
11th October 1922.

No. VII.—SOME NOTES ON INDIAN GAME BIRDS.

Pterocles arenarius.—Finn mentions bags of 54 brace as being remarkable; this to 3 guns, but much larger bags have been made. Notably when the present King shot with the Maharajah of Bikanir.

Polyplectron chinquis.—I found feathers in the recent cooking places at Nam Dip, Rakeng, Siam. I also saw the birds in the Melamoung valley at 2,500 ft. They were always in evergreen jungle. I shot the specimen sent you on the West side of the Dawna Mts. in Tenasserim.

Gallus ferrugineus.—Finn states the breeding season to be the first half of the year. In the dry zone of Upper Burma I found two incomplete clutches in the fourth week in July, and none before the 8th of June. Three eggs on 8th June 1914. Next clutch was four on 7th July 1914, quite fresh. In the lower valley of the Salween I saw a brood of half-grown chicks on 3rd April 1914, and newly-hatched broods in the third week of February 20. On my return journey from Siam last year I saw no birds other than those fully grown. In Siam itself I found fresh clutches as follows:—

30th March 1920. 2 in a hole in the bank of a dry stream-bed. Nest was quite unlined. The hole was about a foot deep.

6th April 1920. 4 between the buttresses at the foot of a big tree. Nest lined with dead leaves.

8th April 1920. 5 in dry leaves at foot of bamboo clump.

26th April 1920. 2 in scrape under single fallen bamboo. The bird sat so close I nearly succeeded in catching her with my hand. The birds evidently nest much later on the side of the mountains away from the sea, than on the side where the early part of the monsoon falls heaviest.

I saw small parties of cocks two or three times, and parties consisting of 3 cocks and 2 hens, and 9 cocks and 7 hens, on 9th February 1920 and 6th April 1920 respectively. I saw no Jungle Fowl on the Ta'ok Plateau.

Tragopan melanocephalus.—I saw this species feeding in company with Kalij, Chir, and Koklass on 24th April 1907 in a nullah in Padar high above the Chenab. The place was a small open grassy slope in the forest from which the snow had just melted. This is the only occasion on which I have seen a gathering of this kind.

Snow Cocks.—In Ladakh, the boundary between the Tibetan and the Himalayan species seems to be the Zanskar River. I saw two packs of the Himalayan Snow Cock (*T. himalayensis*), which numbered 17 and 23 strong on the main ridge, 25 miles west of Lamayuru, on 19th June 1911.

Francolinus chinensis.—Contrary to Finn I found this bird good eating. I have seen it quite 35 feet up a tree very often, and believe it roosts up there, as I have sometimes turned them out of a tree when going out after them in the very early morning before full light. In Siam I found them usually where forest and sandbank meet in the Meping Valley. I regret that of several nests found in the first fortnight of June 1914 I can find only exact record of one in my diary, containing 6 eggs, found on 7th June 1914 situated on a well-drained slope in a clearing in the forest, several miles from the open scrub country they seem to affect out of the breeding season.

Perdrix hodgsoniæ.—I shot one old and one young bird of this species out of a covey of seven which used to frequent a patch of "boortsia" not 50 yards from my tent. This was at a place called Leh Napa in Ladakh about 15 miles from the Nimu Mud ford on the Indus in the first week in August 1911. The young bird was not quite fully grown.

Arboricola brunneipennis.—My specimens B2 and B3 which I sent to the B. N. H. S. are of this species. I do not agree with Finn about their call. They have a distinct morning and evening call, something like "Kuk, ká, Kuk, kuk, ká." It is used much more in the morning than the evening. I only met with them in the Melamoung Siam where they were very common, especially round the Hot Spring. *Tropicoperdix chloropus* I got at Pang Yao and in dense evergreen jungle at the foot of the hills near E Ka Klo. Also in the Melamoung below the hot spring, two or three miles lower down (and 500 feet lower in elevation) than *A. brunneipennis.*

Casarca rutila.—Reference page 121 of Stuart Baker's "Indian Ducks", in the last week of July 1911 I was passing the west end of the Tsokr Chumr lake in Ladakh, and twice saw a Brahminy Duck bring down a young one from the cliffs where they nest in numbers. The first bird passed within about 12 yards of me and I distinctly saw the head of the young one on its back a little to the left of the spine; the youngster seemed well in amongst the old bird's feathers, and she was planing down and had her head rather bent back. The cliffs are about 300 yards from the edge of the lake and she settled on dry land not more than a third of the distance from the starting point. Through glasses I actually saw the second bird start her flight, and she started with a few short wingstrokes and planed down in exactly the same way; but I could not see the young one. I saw it run from her on landing, to the bit of scrub where I found the remaining four chicks. She also did not travel more than about 80 yards towards the water. In both cases I walked to the landing spot and found 4 and 5 chicks respectively. I think chicks are probably brought down by both methods, and that it is also quite possible that two are sometimes brought down at a time, one in the feet and one on the back. In neither case could I see the feet clearly as they were tucked up, but I should think the landing on the hard stony ground would be fraught with considerable danger to the chick brought down in them. On July 9th, 1905, I caught a brood of eight chicks on the edge of the Kyangchu Plain at least 10 miles from any standing water, a small spring a couple of miles away being the nearest water to them. These chicks were about a week old.

C. H. STOCKLEY, Major.

No. VIII.—NOTES ON THE MIGRATION OF DUCK AND TEAL.

I have once again noticed that this season, as in previous seasons in the Punjab, the male birds seem to arrive after the females. My observations are mostly with reference to teal and mallard. I find, on reference to my diary, that during the latter half of last November I shot three teal and two mallard on the Khanna stream, and that all of them were females. My record for December is the same. In both months I shot four duck of other species, only one (a gadwall) being a male. Out of about sixty other duck seen I could only definitely put down two as drakes, a mallard and a red-headed pochard. At least fifty of the remainder were undoubtedly females. In the first half of January (I did not shoot during the second half) I shot eight mallard and three teal, all drakes: the three teal were shot out of a party of six, all of which were drakes but one. In February I shot six mallard and two teal, only one mallard being a female. I examined a flock of about 100 teal resting on a pool in the river in the last week in February, and at least four out of five were drakes. Now, during March, the mallard have mostly gone and their place has been taken by pintail, and the proportion of males and females seems about even, the females perhaps slightly preponderating. I was stationed at Peshawar and the Malakand from Nov. 1903 to March 1907, and I noticed exactly the same thing in just about the same proportions, but my shooting diary for those years is not available, and the only figures I have are 42 teal between September 15th. and October 15th., 1904, of which eleven were garganeys (out of the first 17 shot): of the total, only three garganeys and two common teal were drakes. I put forward these observations with considerable diffidence, as neither Stuart Baker nor Finn remark on this matter, and if it is the usual order of arrival it is strange that it should not have been a subject of comment before.

C. H. STOCKLEY, MAJOR.

CHAK LALA, PUNJAB, 24th *March* 1921.

No. IX.—NOTES ON THE HABITS OF A YOUNG HORNBILL.

For several months my friend Captain Gladstone Solomon and I have been observing the habits of a young Hornbill (*D. bicornis*) we have been keeping in the bungalow. We kept her first of all in a cage, as she seemed not inclined to be friendly. For some weeks she remained like this, and nothing particular happened except a nauseous shrieking continued all day, especially when the hours of 9 a.m., 1 p.m. and 6 p.m., her feeding time approached.

After some weeks a friend of mine, who happened to be staying with us, discovered that the weird inclination of the head and scraping against the wires of her cage accompanied by weird chucklings in her throat, which took place everytime we approached the cage, were meant in a friendly spirit, and moreover experiment showed that the pecks bestowed on one's hand when put to the wires were in reality quite gentle. 'Becky,' so called on account of her marked semitic type of countenance, was inclined to be friendly and evidently liked our company.

Her cage was immediately behind the dining table in the verandah and when guests dined with us the tumult of pleasure increased tenfold and when the time of dessert approached it reached its climax. A stop was always able to be put on this by placing a macintosh over the cage, and it was wonderful the effect darkness had on the bird, silence ensuing immediately. Whistling also had the effect of completely silencing her, and the peculiar way in which she moved her head at such times showed how completely mystified she was. It was a most amusing sight.

We now began to open the cage and let her get out, and then she became a perfect mascot, hopping about the room, and always on the look out for scraps of food, of which she ate anything, plantains being her peculiar delight.

To the butlers at table she showed a decided antipathy, and delighted in trying to give them sundry pecks on the legs suddenly, making them jump and almost drop the plates they were carrying.

However she had on the whole very good table manners, and only forgot herself once in the matter of leaping upon the dinner table, and with her wings breaking all the glasses on an occasion when there was some especially luscious fruit on the table. Her most remarkable performances were what a literary friend of ours termed her ' puja ' (*i.e.*, her religious exercises). This appeared to be due to the remarkable effect the sun had upon her. She used to delight in basking in the sun, when first of all a curious trembling used to take place, followed by an inclination of the head, then the whole wonderful expanse of her wings would extend and the bird became completely prostrate, and offered a wonderful sight with her wings completely stretched, eyes closed, and body absolutely in a convulsive condition. At first we thought that this might be dangerous to 'Becky', but as she continually chose to do it herself and no ill effects happened, we put down 'Becky's Puja ' to the effects of basking in the sun to a bird which had never before experienced heat of this nature, the reason being she had been bred and kept in captivity. Besides ourselves, 'Becky' had several friends, and lived on amicable terms with a hedgehog (Algernon) and two tame monkeys 'Young Jacob' and 'Lizzie' who were just lately wedded. Except for an occasional tiff with 'Young Jacob' when he got more than what she considered fair of his share of oranges, there was perfect concord.

One day she had a very narrow escape, being nearly run over by a car when in an ecstasy performing her Puja. Becky's many friends and admirers will be grieved to hear that she is shortly leaving India to take up her abode in the Zoological Gardens, London.

B. C. ELLISON, C.M.Z.S., F.R.G.S.

BOMBAY, 18*th August* 1922.

(In the case of kites and vultures, the habit of spreading their wings in the sun is commonly observed but I do not think it has been observed with the hornbill.)

No. X.—ON THE BREEDING OF CERTAIN WAGTAILS.

It may be of interest to record the following notes on the breeding of certain Wagtails which came to my notice during the year 1921 :—

1. The Grey Wagtail, *Motacilla cinerea melanope*, Pall.

In the Fauna of India it is stated that the Grey Wagtail breeds in Kashmir above 6,000 ft. and in Afghanistan. This statement appears to be based on the records by Brooks and Wardlaw-Ramsay which are quoted in the second edition of Hume's "Nests and Eggs," Vol. II, p. 207. As regards Kashmir, Ward has confirmed that it breeds commonly. Since then Whitehead (Ibis, 1909, p. 240) has recorded that it nests freely along the streams of the Sufedkoh from 6,000 to 8,000 ft., and Meinertzhagen has shown (Ibis, 1920, p. 147) that it is a widely distributed but very local summer visitor to the mountain streams about Quetta, breeding between 7,000 and 9,500 ft.

Many years ago I ascertained, in the course of a shooting trip, that the Grey Wagtail breeds in Kulu, and in 1921 I was able to verify my observations. It is a common breeding species all along the valley of the Beas from Sultanpur (4,000 ft.) upto at least 9,000 ft. at Rahla, at the foot of the Rhotang Pass. It certainly occurs in some, and probably in all, of the side nullahs which run down into the Beas, as, for instance, the Solang nullah, and the Kraun nulla which runs to the Northern base of the Bhubu Pass. A few pairs, moreover, breed south of the outer-Himalayan range, for on the 17th May I watched a female on to her nest situated at 7,000 ft. elevation at the Southern base of the Bhubu Pass in Mandi State. This nest was a mass of dry grass, bents, and the usual miscellaneous materials of a similar character, with a deep well rounded cup of dry shreds of grass thickly lined with white goat-hair. It was placed on the ground under a bracken plant close upto the perpendicular side of a huge rock, one of a mass of rocks jumbled into the small nullah from which commences the ascent of the pass. There were 4 fresh eggs measuring $19 \cdot 5 \times 14 \cdot 5$, $19 \times 14 \cdot 5$, $19 \times 14 \cdot 5$ and $18 \cdot 5 \times 14 \cdot 5$ mm. They agree exactly with Hume's description. Fledged young were seen on the Beas on 17th June. A couple of birds were seen at 5,000 ft. at the end of June at Banjar so it probabaly also breeds throughout Inner and Outer Saraj.

On crossing the Rhotang Pass I again found the Grey Wagtail in Lahul. There it breeds along the course of the Chandra and Bhaga Rivers at an average height of 10,000 ft.

The nests are exceedingly difficult to find in Lahul as they are built amongst the stones lying in vast confusion all along the banks of the rivers which rush noisily down their stony beds and for the most part are not fordable. Much watching only produced two nests, both at Koksar 10,000 ft. on the 14th June. Both nests were under stones on the side of slight declivities. One contained 5 eggs just hatching; in the other were 4 half grown nestlings with an egg containing a dead chick. In construction the nests appeared similar to that above described.

2. The Masked Wagtail, *Motacilla alba personata,* Gld.

3. Hodgson's Pied Wagtail, *Motacilla alba hodgsoni*, Blyth.

Hartert gives the breeding range of these two Wagtails as follows, remarking that the boundaries are not clearly known.

M. a. personata, Turkestan from Transcaspia to the Altai and the southern end of the Baikal sea, the northern end of the Chotan Tagh, the Oases of Nija. Keria and Ssampula, southwards to northern Kashmir, Afghanistan and North Persia.

M. a. hodgsoni, Southern Tibet and the northern slopes of the Himalayas eastwards from Kashmir.

This unfortunately is not very clear, and authenticated details from the various Himalayan areas are badly wanted. There seems to be very little on record. In the Jhelum Valley about Srinagar, that is to say the so-called vale of Kashmir, *hodgsoni* is an abundant breeding species; this was reported by Cock and Brooks years ago, and has been confirmed by more modern travellers including the writer; it is also the common breeding bird of the Indus Valley about Leh in Ladakh, as was shown by the American, Abbott and confirmed very recently by Ludlow. This year I was able to ascertain that it breeds very commonly along the valleys of the Chandra and Bhaga rivers in Lahul at an average height of 10,000 ft. above sea level. Further east, Brooks reported it as breeding in the Bhagirattee Valley north of Mussoorie.

In Gilgit and Chitral we have apparently the meeting ground of the two races, which is interesting in view of the fact that Gilgit at least is the meeting ground and interbreeding area of *Œnanthe picata* and *E. capistrata.* Though in the case of the Wagtails there is the curious feature that the status of the two races is apparently different. Here *M. a. personata* is a resident and common species, while *M. a. hodgsoni* is less abundant and a summer visitor. Owing to the difficulty of distinguishing the two races in winter plumage and, to a less extent, the difficulty in summer of distinguishing first summer females of *hodgsoni* from either sex of *personata,* records must be accepted with some reserve. But a perusal of the records by Scully, Biddulph and Perreau for these areas shows that considerable attention was directed to the question of these Wagtails and the deductions appear to be correct.

Further east records are still more wanting, but in the Kurram River, from Thall (2,550 ft.) upwards, *personata* is a common breeding bird (Whitehead Ibis, 1909, 240). In Afghanistan we already know that it is abundant and breeds (Wardlaw-Ramsey). While Meinartzhagen (Ibis, 1920, 148) hints that a few breed about Quetta.

It is curious, in view of the above distribution, to note that this year I found the nest of *personata* on the Beas in Kulu at about 4,500 ft. between Sultanpur and Raisan. As I was going along the road which borders the river in this part, I saw a Wagtail collecting insects on a small stony island of the river, separated by a deep but narrow channel from the road side. It was very close to me, a matter of some 25 yards or so and turning a pair of powerful glasses on to it I had no difficulty in identifying a male *personata,* with no trace of black feathers on the back. It was a question of a few minutes only to watch the Wagtail to its nest, which was situated in a hole under a stone on the island. There was then I found a second Wagtail collecting flies on the island, but this was a female *maderaspatensis* (which is the ordinary breeding bird of the Beas Valley) and as she was apparently taking her food to the same nest I rather naturally supposed that the two birds were paired; I was however surprised at some hostility towards her on the part of the cock. Luckily thinking the instance a curious one I continued to sit and watch through my glasses, in order to put the identifications beyond doubt. This gave time for two more Wagtails to arrive, namely, the female *personata* (who was readily distinguishable from her mate by her somewhat duller plumage, though she too had no black feathers on the back) and the male *maderaspatensis.* Both *personata* then continued to collect and carry food to the nest though the male was hampered by his determination to prevent the female *maderaspatansis* taking her mouthful of flies to his chicks. Being at last thoroughly satisfied with my identifications—through strong glasses in bright sunlight at 25 yards—and not wishing to kill the parents of a nest with young, I sent an orderly to strip and reach the island through some shallow water further up, while I continued to watch the birds. The orderly duly reached the nest and reported 5 young birds and 2 addled eggs. He then brought back to me the two eggs and one of the nestlings which had the feathers just coming through the quill. My intention was to try and rear this bird and it took food readily but was unfortunately killed by a cat or mongoose next morning.

The two eggs are now in my collection; they measure 19×15 and 18·5×15 mm. They are broad and blunt, almost oval in shape with a faint gloss. The colour is greyish-white, spotted, speckled, and stippled moderately all over with pale yellowish-brown and ashy-grey.

These were the only birds of the species seen in the Kulu Valley and I am of opinion that their nesting was merely an isolated case.

4. Hodgson's Yellow-headed Wagtail. *Motacilla citreola calcarata*, Hodgs.

Dr. Claud Ticehurst has recently shewn (Bull. B.O.C., Vol. xi., 81) that the correct name of this Wagtail is *M. c. calcarata*, Hodgs., which had been discarded in the Fauna in favour of *M. citreoloides.*

We have in *M. c. calcarata* and *M. c. citreola* a very parallel case to that of the two Pied Wagtails just considered; the grey-backed form is the northern breeding form, while the black-backed occupies in the breeding season a mere southerly Himalayan area. There is again some doubt as to the exact boundaries of the respective areas.

Again in Gilgit both species apparently are found breeding on the same ground. There is some indication that in Chitral also possibly both birds breed, but most observers find some difficulty in distinguishing all but adult plumages of the Wagtail group, and in many cases it is probable that the two immature phases in which *calcarata* is now known to breed have been mistaken for *citreola.*

At any rate it is clear that *calcarata* breeds commonly throughout the vale of Kashmir (Nests and Eggs, Vol. II., 208, 2nd Ed.), in Central Ladakh and Suru (Jour. B. N. H S., xxvii., 144) and the Kagan Valley (Ibis 1909,242). A few also breed towards Quetta (Ibis, 1920,147).

To these known localities I now have to add Lahul, where it breeds commonly, but locally, along the Chandra and Bhaga valleys at a height of about 11,000 ft. from Koksar to the Zaskar Nata. I was unfortunately too early to obtain eggs but, as I was marching back, on the 12th June I found a half built nest at Sissoo.

It is interesting to note that these Wagtails usually nest in the neighbourhood of a species of Bog King-Cup whose brilliant yellow flowers are exactly matched by the yellow heads of the birds.

Attention has been drawn by more than one observer to the fact that a large percentage of individuals of this species breed in immature dress; this applies to both sexes but unfortunately sufficient skins have not yet been collected fully to illustrate this interesting fact. The point may be specially drawn to the attention of any naturalist who has the good fortune to spend much time on the breeding grounds of this species.

5. The Large Pied Wagtail, *Motacilla maderaspatensis*, Gm.

Long ago, Hume dubbed this Wagtail as "irregularly-minded" owing to the diversity of sites it affected for its nest. The following extract from my note book exemplifies this:—

16th April 1921, Kotla 1,500 ft., Kangra Valley.

"When out in the evening in one of the Nallahs below Kotla Fort I saw a male Wagtail sitting in meditative fashion on a niche of the wall of rock rising out of the stream; as he stayed there immobile I concluded that the nest was probably in the neighbourhood, and threw a large stone into the water in the hope that the resulting splash and noise might startle the female off the nest and reveal its whereabouts if anywhere near. The ruse was successful. The splash was followed by the appearance of a second Wagtail which emerged from the wall of rock from a large excrescence which looked like a heavy growth of some rock plant. I could see that there was a hollow in this. I accordingly took off my sandals and waded across the stream, which luckily did not rise much above my knees, and, standing below the rock, could see that the excrescence was in reality an old nest of the Dipper (*Cinclus pallasii tenuirostris*). It was out of my reach and the rock gave no foothold. Luckily at this juncture a balk of timber came floating down the stream and with its aid I was just able to reach the nest and ascertain the presence of eggs. Lifting the nest off its ledge —it came away solid—I waded back to the shingle and secured the hen Wagtail for identification. On examination it proved that the Wagtail had adapted the Dipper's nest to its own needs by lining the cup with hair and wool of various sorts. The Dipper's nest may best be described by likening it in shape and size to one of the Kashmiri Charcoal baskets ("Kangri") that is to say a deep cup with a dome over half the top. This was composed of dry tufts of grass welded together with moss into a very heavy compact and strong structure the size of a football. To continue the analogy of the Kashmiri basket, which has the bottom lined with an earthenware cup, the nest contained a strong and very compact cup lining of coarse grass, which I was able to lift out of the main structure as if it were a separate nest. In this was the Wagtail's nest. The 4 eggs were rather incubated."

HUGH WHISTLER, F.Z.S.,
INDIAN POLICE.

No. XI.—ON THE HABITS OF THE WHITE-HEADED DUCK (*OXYURA LEUCOCEPHALA*.)

Shooting on the 4th December at Bahawalnagar, in the north of this State, a little before the light had gone, I noticed a small flock of about six birds whose appearance on the water rather puzzled me. They were in a deepish canal cut, only about thirty yards wide, and were in the company of a grebe of middle size, whose species I did not discover. This, and the fact they were swimming along ahead of me within shot hardly faster than I was walking, showing very little of their heads and bodies above the water, made me think at first that they were Dabchicks (*Podicipes albipennis*). A closer look made me suspect that they were something in the Duck line, so I got behind some cover and, after moving at an increased pace, came out suddenly level with them. I then saw the heavy, white-patched face and the rounded back, and, guessing they might be White-headed Duck (which by the way are not by any means rarities in this State), fired and succeeded in securing two.

The point that struck me was that the birds seemed to be *partially submerging themselves deliberately in order to escape observation.* Naumann, quoted by Stuart Baker at page 259 of his " Indian Ducks and their Allies," notes this " submarining " habit, but the nearest observation to my own experience is from Chapman and Buck, in their " Wild Spain ", as quoted by the same author on the same page. They note what struck me also, *viz.*, that, *when swimming deep, these Duck carry their tails out of sight under water.* Last year I saw a White-headed Duck close to the carefully-screened butt from which I was shooting, and, thinking it to be a cripple of my own, shot it on the water; it was carrying itself well above the water then, though I was too far off to see with the naked eye whether it was adopting the high Wren-like carriage of its peculiar stiff tail of which most who have seen it speak. On another occasion, many years ago, in Mianwali District in the Panjab, I saw the bird swimming well out of the water and my recollection was that the tail was then carried high.

In all other respects, the flock of which I now write behaved very like grebes when fired at, a trait that Finn and others have noticed. They were very " confidential " both before and after the shot and their short, rounded wings only carried them a very short distance from the place at which I had fired at them.

R. C. BOLSTER,
I.C.S.

BAHAWALPUR, PUNJAB, *8th Dec.* 1922.

No. XII.—AN ALBINO SHOVELLER (*SPATULA CLYPEATA*).

On the 31st October, shooting with Lt.-Col. A.J.O.'Brien near Bahawalpur, I made the acquaintance of the above freak.

Two birds came overhead just as we were taking up our positions to shoot, and Col. O'Brien got them both with a neat right and left.

One of the birds was a Gadwall; the other was an unmistakeable Shoveller, from the large spatulate bill equipped with the usual long lamellae, but in colour it was pure white all over, with both bill and legs orange-pink. It was a female.

I think the supposition that it might possibly be a domesticated bird, the product of civilisation, can be eliminated, as the place where it was shot was sufficiently wild and remote from human habitations

BAHAWALPUR, PUNJAB, *8th Dec.* 1922.

R. C. BOLSTER,
I.C.S.

No. XIII.—DISTRIBUTION OF THE LARGE PIN-TAILED SANDGROUSE (*PTEROCLURUS ALCHATA*).

Of this species the Fauna, p. 59, Vol. IV, says "occurs abundantly .... in the Western Panjab and Northern Sind....". That however is not the experience of Lt.-Col. O'Brien, who has shot a great deal in many places in the Western Punjab, and of myself. So much is this the case that the appearance of a brace among myriads of Black-bellied Sandgrouse (*Pterocles arenarius*) on the 4th December at a shoot in the North of this State was hailed by both of us as a decided event.

Col. O'Brien was struck both by the general appearance of the bird on the wing and by the dissimilarity of its note from that of *Pt. arenarius.* He secured one, a female.

BAHAWALPUR, PUNJAB, *8th Dec.* 1922.

R. C. BOLSTER,
I.C.S.

No. XIV.—NIGHTJARS OF THE SIMLA HILLS.

In response to Mr. Hugh Whistler's appeal I send you the following notes on the Nightjars (*Caprimulgidæ*) found in the Simla Hills.

HORSFIELD'S NIGHTJAR. (*Caprimulgus macrurus nipalensis*, Hartert).—This species I first came across near Solon (4,000 ft.) when a male was obtained in open oak (*Q. incana*) forest on 24th May 1920. Testes much enlarged. A diligent search by a party of five failed to discover the mate.

Since then I have found the species tolerably common in similar localities from 3,000 ft. up to 5,500 ft. It appears at dusk and in April and May its rich double call-note "Chaunk-Chaunk" reverberates through the jungles. According to my experience this species only utters its note when perched on a bush or tree. One male was obtained while in the act of calling. A female obtained on 16th July was heavy in moult. One male on May 14th called repeatedly at dawn "Chaunk-Chaunk-Chaunk," occasionally interspersed with a quadruple call. It is doubtless a summer visitor only.

FRANKLIN'S NIGHTJAR (*Caprimulgus monticola*, Franklin).—Very common on the barer hill sides about 3,000 ft.—4,000 ft. and occasionally seen up to 6,000 ft. or 8,000 ft. but this is exceptional. The only call I have heard this species give utterance to is a loud piercing "Chweep" which it gives vent to at intervals of about four or five seconds as it flies backwards and forwards along the hill sides. It also utters this note from the top of an *euphorbia* bush or from the ground. When flushed a low chuckle is just audible.

On June 3rd, a party of four was seen and a fully fledged juvenile male was obtained. On the same occasion I was watching a male when he suddenly alighted on the ground some little distance away. Waiting to see if he would rise again I walked quietly up to the spot, flushing him first and then the hen a yard or two further on, when I had the satisfaction of finding two fresh eggs—salmon pink in colour, mottled with darker shades of the same and a few underlying blotches of inky-purple. (They measure 29 ×22 and 31 ×22mm.) The male now became very demonstrative coming within 6 feet of me and repeatedly shrieking at the top of his voice. The eggs reposed on the bare earth with loose stones scattered around and without a vestige of shade. The hill-side on which they rested faces due west, so that the heat at this season during the best part of the day, must have been intense.

One was heard about Chandighar (Ambala Dist.) on March 19th. So it possibly breeds in the Siwaliks.

THE JUNGLE NIGHTJAR (*Caprimulgus indicus indicus*, Lath.).—In the immediate vicinity of Simla this appears to be the prevailing Nightjar, though it can scarcely be called abundant. There are usually two or three pairs scattered about the "Glen", another pair frequents the steep nullah between "Elysium Hill" and the Walker Hospital, while further out two or three pairs take up their quarters in "Cherot Nullah" and still further out I have seen four or five males on the wing at one time in "Chauki Nullah". The feeding areas of this species are apparently the open glades contiguous to dense forest to which they retire in the daytime. The elevation of all the above localities is roughly 6,000-7,000 feet. The call-note is as described by Mr. B.B. Osmaston (J.B.N.H.S., Vol. XXVII., p. 949) besides which the males utter a soft, not unmusical, note "you-you-you" while chasing another bird (probably the mate).

I am not clear about the status of this species; they are at their breeding stations and calling vigorously by the end of March, and on two occasions I have met with individuals in winter: a male was seen at a distance of some 6 yards at 3,000 ft. at Kalka on 6th December, 1919, and a male was secured, at about 7,000 ft. sitting on a spruce fir on 22nd October 1922.

The Common Indian Nightjar (*C. asiaticus asiaticus*, Lath.).—Common about the Siwaliks at Chandighar as noted by Mr. Hugh Whistler (J.B.N.H.S., Vol. XXVII., p. 367). And also about the outskirts of forests and in the stoney nullahs at Kalka, 2,500 ft., above which it does not appear to ascend. The note of this species has been often described; it is usually uttered from some elevated position and is very ventriloquistic.

A female obtained 17th. February had the ovaries much enlarged and would have laid within a month.

It is also common in the scrub jungle about Ladwa, Karnal Dist. The status of the species is not clear.

Ambala, 18*th November* 1922. A. E. JONES.

No. XV.—APPEARANCE OF THE MUTE SWAN (*CYGNUS OLOR*) NEAR POONA.

This is, I believe, the first time that a specimen of the above has been recorded anywhere so far south in India as the Bombay Deccan.

I was out at Kesurdi, a small tank on the Poona-Sholapur Road, about 23 miles east of Poona, on the evening of 11th November 1922.

On first arriving at the tank about 4 p.m. I saw nothing from the lower end except a large flock of common red-headed pochard in the middle, but after walking along beneath the bund for a short distance to get a closer view, on again looking over the bund I saw the swan in the middle of the pochard, so that he had apparently only just arrived.

The bird, when I first saw him, was about 150 yards away, and I watched him carefully with my glasses. He gradually came towards me until he was only about 100 yards distant, and I was in hopes that I might be able to get a shot but he never came any nearer. After remaining for about a quarter of an hour swimming slowly about and feeding, he flew off in a south-westerly direction so far as I could see, but I very quickly lost sight of him behind the trees on the west edge of the tank.

The black face of the bird was distinctly visible through the glasses but I could not distinguish a knob of any size, so that it was probably a young bird. The plumage was pure white except for a greyish patch on the tip of the wing or on the rump, probably the former, as this patch was distinctly visible when the bird flew off.

Another feature that I particularly noticed was the peculiarly graceful 'S' shaped carriage of the neck which again distinguishes this bird from *Cygnus musicus*. I shall be very interested to hear if any reports of any further appearances come in. I can only account for his appearance so far south as this by the fact that during the last week there have been phenomenal rain and thunder storms in these parts which may perhaps have been accounted for by some severe storms in the north. The only other possibility is that the bird may have escaped from some Zoo, or have been a tame bird from some private waters.

Club of Western India Poona. W. B. TREVENEN,
13*th November* 1922. Major.

No. XVI.—A NOTE ON THE MIGRATION OF THE EASTERN GREY WAGTAIL (*MOTACILLA CINEREA MELANOPE*, Pall.).

This race of the Grey Wagtail is said by Hartert (V.P.F.I., 302) to breed from the Ural and the Caucasus through Siberia to Kamtschatka and the Kurile Isles but not north of the 64th degree. He adds that it appears as a migrant in the countries south of that area, through India, Anadamans, The Sunda Isles Celebes, Moluccas, New Guinea, Hainan, and Formosa.

In the area with which we are more immediately concerned it breeds in varying degrees of abundance about the hills of the North West Frontiers of India. I find the following breeding records. In the hills about Quetta it is widely distributed but very local, breeding between 7,000 and 9,500 ft. (Meinertzhagen, Ibis, 1920, 147). It nests freely along the streams of the Sufed Koh from 6,000 to 8,000 ft. (Whitehead, Ibis, 1909, 240). Wardlaw Ramsey found it breeding in Afghanistan. It appears to breed throughout Kashmir including Chitral and Gilgit at elevations over 6,000 ft.

In my own experience it breeds commonly in Kulu from 4,000 ft. upwards and in Lahul at altitudes of 10,000—12,000 ft., though I did not meet with it in Spiti. Brooks found it nesting in the Bhagirattee Valley (S.F., iii, 250). Osmaston found it common about 9,000 feet in the Tons Valley, Gahrwal (Jour., B.N.H.S,, xi, 67).

Further east I have traced no breeding records for the Himalayas and other ranges of the North East Frontier.

Published records, which need not be detailed here, shew that in winter the Grey Wagtail spreads throughout the whole of India, Ceylon, Burma and Tenasserim, even visiting the islands of the Bay of Bengal, *viz.*, the Andamans and Nicobars.

An endeavour to trace its migrations is very unsuccessful owing to the lack of carefully recorded observations. In the North West the first migrants appear in the last ten days of August. Thus Whitehead says that it appears in the plains of Kohat towards the end of August. At Simla in 1918 and 1922 the first birds were observed on 20th August. At Dalhousie I have seen it on 28th August, and at Dharmsala my first records for 1921 and 1922 have been on the 24th August and 19th August respectively. Throughout September migrating birds are found commonly all along the Outer Himalayas of the Punjab.

In addition to the hill records for August I have two for the plains namely a female shot by myself at Hissar on 23rd August 1914 and one shot as far south as Chikalda Berar on 22nd August 1912 by J. Donald (Jour., B.N.H.S., xxi, 1329).

The migrating birds must move South very rapidly as I find that by the end of September the species may be found throughout its Indian range. At Gujranwala, Punjab, I have obtained it personally on the 15th September. At Mount Abu and Northern Gujarat it arrives about the beginning of September (Butler S.F., iii, 489). Whitehead first observed it at Sehore, C.I., on 26th September (Jour., B.N.H.S., xxi, 160). Davison says it arrives in Southern Mysore in September (S.F., x. 395) and Bourdillon (S.F., iv, 401) says that it arrives early in September in the Travancore hills.

On the Eastern side its progress seems to be equally rapid. Scully says that it is common in the valley of Nepal from the beginning of September. It arrives in Upper Assam in September (Stevens, J.B.N.H.S., xxiii, 266). In the islands of the Bay of Bengal Hume obtained four specimens from the 4th to the 9th September. (S.F., ii., 237), and Hopwood has recorded the 20th September as the date of the first appearance in Arakan (J.B.N.H.S., xxi., 1206).

The movement of the Grey Wagtail northwards on the spring migration is not easy to trace as the records are somewhat contradictory. Commencing from the South, Bourdillon states that it does not leave the Travancore Hills till May, and Butler saw it at Belgaum as late as the 10th. May (S.F., ix., 410). It is also said to be common round the lake at KodiKanal and on the small streams of the Palni Hills till the beginning of May (S.F., x, 477). Yet in Southern Mysore they are said to have almost all left by the end of March (S.F., x. 395).

At Sehore, C.I., Whitehead gives the date of its departure as April 1st ; Butler says it remains quite till the end of April in Northern Gujarat, and Stevens gives it till April in Upper Assam.

In the Punjab plains I have no note of it later than April 12. At Dharmsala however in 1921 and 1922 I have found the spring migration in force through April till about the middle of May.

It would be of interest if our members would send in their notes on the occurrence of this bird in different areas, with special reference to its status.

HUGH WHISTLER,

DHARMSALA, *10th November* 1922. INDIAN POLICE.

[The note given above though primarily written for the benefit of an individual member of the Society is of interest to all our ornithological members and is therefore published in the Journal.—EDITORS.]

No. XVII.—THE ROOSTING FLIGHT OF CROWS.

I am inclined to support Mr. H. Whistler's opinion that the flight of crows described in Mr. Basil Edwardes' letter (in Note No. VIII, page 804, Vol. XXVIII), was merely the usual evening flight to their roosting places ; in corroboration the following notes may be of interest :—At Roorkee, in the N.-W. corner of the U. P., during the cold weather from November to March, the crows flight regularly every evening to roost in a huge tract of " nurkul' or " null " grass in the Solani Kadir about 15 miles away. One sees them leave the station about 5 p.m. ; while at the other end, near the roosting place, the flight of crows begins about 5-30 p.m. and lasts about 20 minutes to half an hour ; the column being about 200 yards wide and stretching as far as one can see some miles ; the column is doubtless joined *en route* by all the crows in villages near the line of flight. One curious thing is that they are extraordinarily punctual ; night fall being at that time of year 6-15 p.m. The particular bed of " nurkul " patronized by them is about 2 miles by ¾ mile wide, the grass being some 15-feet high, and very dense, and growing in deep water. Besides the line of flight from the N.-W., from Roorkee, there are two other similar columns arriving at the same time, one from the North and one from the East, these consisting doubtless of the crows from the villages in those directions ; these two columns are of the same size as the first as far as one can judge ; so the number of crows roosting there must run well over the hundred thousand. All the crows are the Common Grey-necked kind (*C. splendens*), I do not recollect ever seeing a single Jungle crow (*C. macrorhynchus*).

The natives say that the reason for choosing these grass beds is, that the crows get shelter from the night wind and warmth, and are safe from cats, etc., and that the only thing that does get at them is a big owl. I have sometimes heard at night an appalling uproar among the crows there, probably due to such an attack.

During the hot weather and rains on the other hand, the crows of the above species flight at evening into the station and roost in the trees there, probably because they get the benefit of any wind there may be, and are cool. They are such a nuisance in the native soldiers' lines, that it is customary for the officers to organize crow-shoots in the rains to get rid of them. The flights at this time of year are however small, only small parties of crows, and one does not see the huge columns, doubtless since every village has the crows from the country round it roosting in the trees in the village.

The above is from my personal observation during most years in the past 20 years, and the same roosting bed of grass has been in use during that period.

SRINAGAR, *26th August* 1922. A. H. CUNNINGHAM,

COLONEL.

[The Dusky Horned Owl (*Bubo coromandus*) kills numbers of crows at such roosts.—EDS.]

No. XVIII.—THE HOMING FLIGHT OF THE COMMON HOUSE CROW (*CORVUS SPLENDENS*).

I fully endorse Mr. H. Whistler's explanation of the flight of crows commented upon by Mr. Basil Edwards in Vol. XXVIII (pp. 804 & 5) of this journal. It is the usual habit of these birds to congregate at night to roost. The most notable example within my experience may be witnessed every evening in Colombo. For an hour or more before nightfall all the crows in Colombo and its immediate environs wing their way in a steady current to an Island at the mouth of the Kelani ganga called Crow Island. The island as I remember it was about half a mile long by quarter of a mile, formed by the detritus washed down by this large river. It is closely covered with cocoanut trees, and in the evening the branches are black with crows and the air a veritable Babel with their cries. I doubt if any crows roost in Colombo outside the Island. In my young days when I indulged in bird nesting I never remember seeing a crow's nest except on this Island. The very large majority if not the entire crow population nested there. In India it is a common sight in many towns to see crows all flying in one direction in the evening to a single rendezvous.

Karachi, F. Wall,

18*th November* 1922. Colonel, I.M.S.

No. XIX.—THE SPOTTED-WING STARLING (*PSAROGOLOSSA SPILOPTERA*, Vigors).

In Mandi Native State (Punjab) this year, 1922, I have come across the Spotted-Wing Starling for the first time.

I first met with the species on the road two or three miles below Guma, at an elevation of between 4,500 and 5,000 feet on 4th June. Here a couple were perching on the tops of some fig-trees by the road side and flying into the air to capture insects after the manner in which starlings and pastors often behave.

They were not seen again until the bridge over the Uhl River (4,000 feet), four miles below Kataula : here on 6th June there was a small colony frequenting the light jungle which clothes the side of the gorge, flying about in twos and threes, and feeding on the berries of a small tree somewhat resembling the Drake tree. In manner and movements they were very reminiscent of pastors and as seen in life I could believe them to be nothing but starlings of some species. They were somewhat shy and very restless, continually moving from one place to another with swift strong flight.

There was another small colony at Kataula (4,000 feet) where in the evening one or two small parties of four or five birds were moving about and perching on the tops of trees—again after the manner of starlings preparatory to the roost.

A series of two males and three females was obtained on 6th June ; all were adults in worn plumage and the moult had not commenced. From the state of the organs and the remains of incubation patches in the females I am of opinion that the breeding season was practically over, but a female seen at the bridge was carrying food. It is however remarkable that, so far as I could judge, there were no young birds with the adults in either colony. No birds were seen when I marched over the same road again in the beginning of August.

Having made acquaintance with the Spotted-Wing Starling in the flesh I was naturally eager to learn something about its distribution and status, and therefore looked up all the records available to me. It is curious how little is really known about the bird. It has seemed therefore of value to put together in a connected whole the records which I have found, in the hope that our readers may thereby be persuaded to send to the Journal whatever information they possess on the subject. For, as at present known, its distribution is distinctly curious and its status is hard to define.

The most westerly point from which the bird has been recorded is Dharmsala from where there is a male in the Hume collection without date. I personally have failed to find it at Dharmsala. Then come my records above from Mandi State.

Jerdon says (B. of I., II., 3367) : "It frequents the valleys about Simla and Mussoorie up to 6,000 feet, lives in small flocks of 5 or 6. " He goes on to quote Hutton that the note and flight are very much like those of *Sturnus vulgaris* and it delights to perch on the very summit of forest trees, but does not perch on the ground ; the food appears to consists of berries. Adams is his authority for stating that it frequents rice-fields and the sides of mountain streams and is shy and timid.

The Simla locality has since been confirmed by Mr. A. E. Jones who has been kind enough to give me his notes. He has not seen it as high as Simla, but only in the valleys below in the Hill States. He saw a pair on June 1913 at Suni, Bhajji State 2,500 feet. Otherwise he has only met with it towards Jabli 3,500 feet in Baghat State. Here in April on the 15th, 16th and 30th he met several small flocks ; those of the 16th April appeared to be travelling up hill and were perhaps migrants just arriving. On the 24th May he secured C/3 eggs. On 25th June the birds were still about and young birds were on the wing. Mr. Jones remarks that the call note very much resembles that of *Æthiopsar* and *Acridotheres* while the flight is that of *Sturnus*.

Brooks confirmed the Mussoorie locality in his trip in May 1874 (S. F., III., 254). He says : "Common at this side of Dhunda and also seen between Sansoo and Kauriagalia. It breeds early, for I saw fully-grown young in the end of May."

Tytler met a few birds in the valleys between Simla and Mussoorie in June (Ibis 1868).

For this western area we may hazard a guess that the Spotted-Wing is a summer visitor arriving in April and leaving in July after breeding at the end of April and May. It would appear to be one of those species with an east to west migration.

A single specimen was obtained by Anderson at Futehgahr on the 2nd June (F. B. I., Vol. I. 249). This must have been a straggler. There is then a gap in its known distribution until we meet with it again in Assam which appears to be the main stronghold of the bird.

In Western Assam, Godwin-Austen recorded it from the Garo Hills and in the Khasia hills Stuart Baker states that it is common but probably does not breed, (Jour., B. N. H. S., XVII., 790).

In Upper Lakhimpur district according to Stevens (Jour., B. N. H. S., XXIII 254) it is found throughout the plains in the cold weather (specific records for Margherita, Sejoo, Lilabari and July-September-October being given) in flocks upto 400 in number in company with *Æthiopsar fuscus* and *Sturnia malabarica ;* he says it is a typical starling in habits and frequents the tops of forest trees

In N.-E. Cachar, Inglis states that it is very rare as he has only obtained young male near Dilkhushah (S. F. IX. 256).

In Dibrughar district, according to Cripps (S. F. XI. 268), it occurs in good-sized flocks in the well wooded portions of the district. The flocks are very wary and keep well out of range when feeding. The food consists of insects found in the flowers of trees, red tree-ants, and berries.

The above records for Assam seem to indicate that it is there a winter visitor, but if so where do these numbers of birds breed ?

In Burmah it is less common. Hume met a few on the Noonzarban ridge in Manipur (S. F. XI. 268).

Wardlaw-Ramsey found it not uncommon on the thickly wooded slopes of the Karen Hills east of Tounghoo (S. F., VI., 394). Dr. Armstrong obtained a pair on 1st January in low scrubby jungle near Elephant Point, Rangoon (S. F., IV., 334), and Hume remarks (S. F., XI., 268) that he has received three other specimens from the neighbourhood of Rangoon.

It has been doubtfully recorded from Mooleyit in Central Tenasserim.

To sum up :—It is found locally and in small numbers as a summer visitor to a portion of the western central Himalayas ; it is abundant as a winter visitor to Assam ; in Burmah it is local and scarce.

HUGH WHISTLER, F.Z.S.,
INDIAN POLICE.

DHARMSALA, 20*th September* 1922.

No. XX.—A NOTE ON THE EASTERN RED-LEGGED FALCON (*ERYTHROPUS AMURENSIS*).

Living about 50 miles north of Taunggyi, the Headquarters of the Southern Shan States, I have noticed this year towards the end of April and the beginning of May, the visit, during migration, of numerous specimens of this pretty hawk.

The birds are very gregarious, feeding, in parties of at least 30 individuals, on flying termites, settling on the ground to pick them up and also catching them in their claws in the air as other birds. The country here is dry and very bare of trees ; mostly grass and some scrub.

Sitting on the open verandah of the house, which seems to be in the line of evening flight of the Jungle Crows going to roost in the trees near a village in the neighbourhood, I counted well over 100 of these little hawks going over in company with the crows on the 3rd of May ; they were then flying S.-W., about 30 yards up singly and in parties of upto 5 or 6 in number, evidently going to roost with the crows. On the 4th I noticed that there were fewer and on the 5th only a few solitary birds and now on the 10th none are to be seen anywhere.

LAWKSAUK, SOUTHERN SHAN STATES,
BURMAH, 10*th May* 1922.

P. F. WICKHAM,
P.W.D.

No. XXI.—NOTE ON THE NESTING HABITS OF THE SPOTTED BABBLER (*PELLORNEUM RUFICEPS*).

While up at the little hill station of Yercaud, in the Salem District, last hot weather, I had the good fortune to find two nests of the Spotted Babbler (*Pellorneum ruficeps*). One on the 21st of April and the second on the 3rd of May. In both cases the nests were placed on the ground in amongst dead leaves which were similar to those used for roofing the nests over with, making them extremely hard to find. The first nest I found by putting the bird off the nest ; I at first thought it was a rat running away amongst the dead leaves as it went off at such a pace, but, after getting some distance off, it commenced tumbling about amongst the dead leaves when I saw that it was a bird and was obviously trying to attract me away from a nest. I then made a minute search and at last discovered the nest with 3 eggs in it which were in an advanced state of incubation. I had not a gun with me at the time but went back the next day to shoot the bird but failed and the day after this the bird had deserted the nest.

In the case of the second nest I was seated on a shooting stick under some tall forest trees when my attention was attracted by something running about in the leaves, closer examination showed it to be a bird tumbling about in the leaves as though injured and at times hiding in amongst the leaves only showing its head. I then looked about and found that I was sitting within 2 feet of the nest which contained 2 fresh eggs. I subsequently shot the bird when going into the nest and sent the skin to the Secretary, B. N. H. Society, for indentification. The nests were constructed in a hollow in the dry leaves and were hooded over on three sides leaving a small entrance facing down hill, and were so well camouflaged that unless one obtained a view of the entrance it would be impossible to find the nest. The actual nest was a shallow cup lined with grass and fine roots.

The eggs found in the two nests vary a bit. Those found in the first nest have a greenish-white back ground and are very profusely spotted with dark brown spots and blotched with purplish-grey. The eggs in the second nest have a far lighter back ground being nearly white and are finely spotted all over with brown and purple-grey spots.

VELLORE, NORTH ARCOT DISTRICT,
14*th July* 1922.

C. B. BEADNELL.

No. XXII.—LIST OF SMALL GAME SHOT IN MHOW DURING 1921 AND 1922.

I enclose a detailed list of small game shot by me in the past 1921-1922 season for inclusion in your records if of sufficient interest :—

Duck.

Gadwall ..	211				
Red-headed pochards	11				
Tufted ,,	28	Red-crested pochards ..	4	White-eyed pochards ..	17
Nukkta ..	1	Spot bill ..	2	Widgeon ..	19
Pintail ..	2	Shovellers ..	50	Total duck ..	345

Teal.

Common ..	57	Gargany ..	47		
Cotton ..	20	Whistling ..	6	Total teal ..	130

Various.

Sandgrouse (pintail)	201	Quail ..	19		
Partridges (mostly painted.)	53	Pigeons ..	8	Various ..	3
		Florican ..	6		
Hares	10	Snipe ..	679		

Making a grand total of 1,454

The jhils were mostly well filled with water except in a small area between Indore and Fatehabad, and on the whole snipe were plentiful but duck were very scarce except on the largest jhils. The Gadwall is the commonest duck here but this year's bag shows an unusually high percentage; Widgeon are usually scarce, but were more plentiful than usual; Pintail, Red-headed Pochard and Common Teal were exceptionally scarce. On one occasion I saw a female Mallard in another officer's bag, and this was the only one seen by me alive or dead. Geese are rarely seen here but early in February a flock of about 25 passed me in easy range when motoring, but I could not distinguish the species as I was driving.

The first snipe was shot on September 24th and a few Whistling Teal were seen on the same day.

MHOW,
8*th May* 1922.

F. C. L. GRIEVE,
MAJOR, R.F.A.

No. XXIII.—FURTHER NOTES ON THE AVIFAUNA OF THE NELLIAMPATHY HILLS.

NIDIFICATION OF THE GREAT MALABAR BLACK WOOD PECKER (*Thriponax hodgsoni*).

In my "Rough notes on the Avifauna of the Nelliampathy Hill" I referred to the finding of a nest containing 2 naked nestlings of this species. I have this year been fortunate enough to secure the hitherto unknown eggs of this bird which I, in due course, forwarded to Mr. Stuart Baker. I later obtained 2 young *Thriponax* but unfortunately was unable to keep them alive. Their remains are being sent to the Society. These three instances prove that this most interesting wood-pecker lays two eggs and not one as wrongly surmised by Blanford.

COMPANIONSHIP BETWEEN THE SOUTH INDIAN TREE-PIE (*Dendrocitta leucogastra*) AND THE GREATER RACKET-TAILED DRONGO (*Dissemurus paradiseus*).

Seldom a day passes but I see several small groups of the above two birds. I do not think I have yet seen one species unaccompanied by the other. This somewhat curious association between two totally unrelated forms induces me to wonder whether a similar companionship between these species has been observed elsewhere.

OCCURRENCE OF THE MALAY BITTERN (*Gorsachius melanolophus*) IN SOUTHERN INDIA.

Regarding Lt.-Col. H. R. Baker's note concerning this bird in Vol. 28, No. II of the Journal, his query also appeared in the "Madras Mail" and I replied in the same journal to the effect that before the War I found the Malay Bittern not uncommon in the Nilambur valley; a specimen I there obtained, in all probability, is still in our museum. During the cold weather before last, I saw a specimen of this bird at the foot of the Palghat Hills.

NELLIAMPATHY HILLS,
15*th May* 1922.

A. P. KINLOCH, F.Z.S. M.B.O.U.

No. XXIV.—THE GREAT INDIAN HORN-BILL (*D. BICORNIS*).

Regarding Mr. Prater's very interesting note on these birds appearing in Vol. 28, No. II of the Journal.

When the Society issued an appeal for a replacement of what the "Journal" irreverently referred to as "Big Bill", my father and, on his death, I myself did our best to replenish the vacuum created by our old and "Conky" friend's demise.

Unfortunately my "Young Bill" arrived after the Society had secured its twins. A point Mr. Prater appears to have missed (?) is this : When "Armaggeddon" sought my protection his eyes were sky-blue. His casque is now developed upto, and no further than, the illustrations Mr. Prater gives us. But his eyes have now assumed a rich brown tint.

NELLIAMPATHY HILLS,
15*th May* 1922.

A. P. KINLOCH, F.Z.S., M.B.O.U.

No. XXV.—NIDIFICATION OF THE BLACK VULTURE OR INDIAN KING VULTURE (*OTOGYPS CALVUS*),

With reference to Colonel O'Brien's note on this subject (Journal, B. N. H. S., XXVIII, p. 284) I once found a nest of this bird on top of a Phulah bush (*Acacia modesta*)—it was not big enough to be called a tree—growing on the highest point of a sand-stone ridge in the broken country at the foot of the Salt Range, and in close proximity to the Jhelum river. One bird was sitting in the nest, then empty, and the other on another ridge close by. A fresh egg was taken from the nest nine days later, on the 5th March.

On the 18th March another egg was brought to me which had been taken that day from a nest on the top of a small Phulah tree growing on the precipitous and well wooded side of a Salt Range valley. It was slightly incubated.

I have never found nor heard of this bird nesting in the cliffs of the Salt Range.

JHELUM, H. W. WAITE,
26th July 1922. INDIAN POLICE.

[In an Ornithological Diary from Jhelum published in "Bird Notes" for 1914, Mr. Hugh Whistler has noted under April 14th: " An egg of the King Vulture obtained from the hilly ground at the foot of the Salt Range about 12 miles from Jhelum; in this part trees are exceedingly scarce and this nest, as also a second nest containing a newly hatched young bird, was built only about 15 feet from the ground on a gnarled old thorn tree. The nest which was very large and appeared to be the accumulation of years was lined with coarse hill grass." This note clearly refers to the same locality as the nests observed by Mr. Waite and it is clear that in the Salt Range the King Vultures have modified their requirements in the choice of tree nesting sites rather than have recourse to cliffs.—EDS.]

No. XXVI.—BREEDING OF THE EASTERN WOOD PIGEON (*PALUMBUS CASIOTIS*) IN THE PUNJAB SALT RANGE.

On the 12th April last I found a nest of this bird in the Jhelum portion of the Salt Range, at an altitude of about 2,000 feet.

The locality was the thickly wooded bottom of a narrow valley (part of a Government Forest Reserve), through which a small stream of fresh water flows down to the plain below. The trees are mostly Phulah (*Acacia modesta*), Tahli (*Dalbergia sissoo*), Kikkar (*Acacia arabica*), Ber (*Zizyphus jujuba*), and Mulberry (*Morus alba*).

The nest was on the branch of a Ber tree, roughly 20 feet from the ground, and contained two half-fledged young. The parent bird was on it, and sat very close, taking no notice of clods of earth thrown into branches near by, and only flying off when a man started to climb the tree. I watched her with glasses for a considerable time, both on the nest and in the tree to which she subsequently flew, and have no doubt as to her identity.

This bird is ordinarily a winter visitor to the Jhelum District, and its breeding in the Salt Range is probably a sufficiently rare occurrence as to be worthy of record.

I may also mention that a few years ago, on the 13th April, I found a nest, with 3 eggs, of the Indian Bush Chat (*Pratincola maura*) in a hole in a rock in the same locality.

JHELUM, H. W. WAITE,
26th July 1922. INDIAN POLICE.

[See next page for note by Editors.]

[The Eastern Wood Pigeon breeds not uncommonly in the Salt Range about Sakesar and eggs have been taken there as late as August 1st.

As regards the Bush Chat the nest has already been found in the Salt Range (N. & E. 2nd ed.: ii. 48) but it is interesting to have confirmation of the earlier vague record.—EDS.]

No XXVII.—LATE STAY OF SNIPE IN 1922.

In Central India.

This morning Major Barker, R.E., and I found four full snipe (fantail) on a tank near Indore and shot three of them.

This is the first instance I have known of snipe being shot in May in Central India.

PERCY HIDE.

THE DALY COLLEGE, INDORE, CENTRAL INDIA,
1st *May* 1922.

In Bengal.

As I and other sportsmen here have never known snipe so late in Bengal as this year, I think perhaps it may interest you to know that on Sunday, the 23rd April, I shot 21½ couple on a *Jheel* not far from Calcutta. Had I not run out of cartridges I could have got another 10 couple. My shikari had unfortunately told me the previous day that there were about 20 birds on the *Jheel* and I had provided accordingly. On the following Saturday, the 29th April, I shot the same *Jheel* with a Mr. Steele-Perkins, and we ended up with 17½ couple. I again went out yesterday, the 7th May, and on an adjoining *Jheel* shot 11 couple. Old sportsmen here consider the above bags records, and this appears to be confirmed by Mr. Stuart Baker's book on the Game Birds of India. I should be very much obliged if you could let me know of any similar records at this time of the year. Nearly all the birds were pintails.

T. E. T. UPTON.

STANDARD BUILDINGS, CALCUTTA,
8th *May* 1922.

No. XXVIII.—CRUELTY TO WILD FOWL.

HIDEOUS PRACTICE IN SIND.

The following appeared in *The Times of India*, dated 19th January 1923.

(*By P. M. D. Sanderson, Joint Honorary Secretary, Bombay Natural History Society.*)

On returning from a shoot recently near Jhangshai, Sind, I noticed at Karachi Railway Station, two large crates—one containing live Wild Geese (Greylag) and the other Wild Duck (Mallard, Gadwall and Teal). The birds in both crates were literally crammed together one on the top of the other and unable to move. The precaution had also been taken of breaking their wings and in some cases their legs.

There is, I fear, little reason to suppose that this was a solitary instanec. Numbers of Wild Duck were on sale (alive), in the Bazaar at 6 to 8 annas each (large) and 4 annas (small). I imagine the transport of wild fowl under these conditions is a matter of almost daily occurrence and is carried on under the open eye of authority, although the consignor took good care to avoid conspicuous names and addresses on the labels which in this case merely bore illegible initials in pencil.

Some years ago one or two members of this Society drew attention to the practice of netting Wild Fowl in Sind and transporting them alive to Karachi for sale. The authorities took the matter in hand and for a time at any rate this traffic was more or less successfully suppressed. It is not possible, I believe, to stop the netting of Wild Duck, Geese, etc., but the method of treatment after netting has reached such a pitch of cruelty that I am sure the public, were they in possession of the facts, would not allow this abominable practice to exist for a moment.

The method commonly employed is to choose a likely place and put up a net about half a mile long and some 8 feet high from the water. Under cover of night men in boats stealthily approach the birds and drive them slowly, without putting them up, towards the nets. When close enough they throw lighted torches at the birds which, suddenly alarmed, immediately take flight, but are too close to rise clear of the nets. They become entangled and their captors take them out, break their wings, and very often their legs as well, to prevent escape. In addition to this the wings are sometimes locked, *i. e.*, one wing is twisted over the other. This practice is almost universal, I believe, with the Mohannas in Sind. In this state the birds are kept alive for days and then sent to Karachi in crates as described above ; the journey itself sometimes takes at least 2 or 3 days from the " jheel " to the bazaar. In a successful drive as many as 200 birds or more can be obtained in this way as there are often four or five nets up at a time.

I think you will agree that this miserable and wanton practice, which has been going on for years, should be not only suppressed but rooted out now, once and for all. The Railway authorities and Railway Police if they wished could bring offenders to boot. Few prosecutions, however, have, I believe, been made in the past and I doubt if there is a single conviction on record. It remains for public opinion to see that either this is done properly or to press for sterner legislation and more efficient methods. The torture of Wild Duck with broken and twisted wings would then be a thing of the past instead of the daily example of hideous cruelty which it now is in the Karachi Bazaar.

Commenting on the above Mr. H. Dow writes :—

" Ten years ago I was in charge of the Sehwan Sub-division, which contains the Manchhar Lake, and I took some pains to try to stop the practice you complain of, and actually did mitigate it.

There is one point in your description which is not, I think, quite correct. You say : " They become entangled and their captors take them out, break their wings, and very often their legs as well to prevent escape." Actually (at any rate where I have seen it) the breaking of wings and legs takes place while the birds are still in the nets, and without removing them. The real difficulty of the Mirbabars is that the birds struggle violently and tear the nets and if they stay to kill the birds outright, most of the birds succeed in tearing their way out of the nets before their captors can get round and killing the captured bird takes much longer than breaking its legs or wings, at which the men are very expert. I have frequently been present at one of these night drives in order to satisfy myself of these facts, and it is true that if the men stop to kill the birds at once, most of the duck succeed in freeing themselves.

The really objectionable feature is that after the bird has been made helpless by breaking its wings, it is not then despatched, but is kept alive for several days. There is no excuse for this, and it could be stopped by (1) forbidding the transport of live wild fowl by rail, and (2) making it a penal offence to be in possession of mutilated live birds. Probably the first would be sufficient."

Our readers and all those interested in the above, will be glad to know that His Excellency the Governor, President of this Society, took a personal interest himself in the matter. Owing to his prompt intervention we are able to state that immediate measures were taken to stop this practice. We have no doubt that these will be successful, and will once and for all put an end to the unnecessary cruelty to Wild Fowl in Sind.

We have pleasure in appending below a letter from the Commissioner in Sind to Mr. C. G. Adam, Private Secretary to H. E. the Governor, forwarded to the Society under His Excellency's instructions, showing what steps have been taken to prevent the recurrence of this cruel practice.—EDITORS.

"I write in reply to your letter of the 19th January regarding the cruel treatment of the wild duck that are netted on the Manchhar and sent by rail to the Karachi market. The District Magistrate of Karachi, to whom I referred your letter, had already taken up the question, and has addressed the local branch of the Society for the Prevention of Cruelty to Animals with a view to the institution of prosecutions against the sellers of wild birds which are transported in overcrowded crates or have broken wings or legs, and has asked that the officials of the Society may be instructed to press for exemplary punishment in such cases. The question was considered at a meeting of the Society held on the 27th February, when the officers of the Society reported that the sale of wild duck in Karachi had ceased. This of course is due to the fact that most of the duck had left Sind by that time. The officers have, however, been warned to be on the look out next season. The District Magistrate at the same time had a letter inserted in the local newspapers drawing attention to the cruel practices complained of and warning the public of the action that would be taken to stop them.

The District Traffic Superintendent, N. W. Railway, was also addressed with the result that a circular was issued under the authority of the Traffic Manager to all Station Masters informing them that they are authorised to refuse to take over any crate containing live wild birds of which any have their legs or wings broken and directing them in every case of such refusal to report the case immediately to the District Traffic Superintendent with a view to its being handed over to the Police for action. The Station Masters were also directed in cases where such crates booked from other stations are received for delivery, not to effect delivery until the Police have been informed and have witnessed the condition of the birds.

I have also addressed the District Magistrate, Larkana, within whose jurisdiction the Manchhar Lake is situated, on the subject, but have not as yet received any reply from him."

(Sd.) J. L. RIEU

No. XXIX.—SNIPE SHOOTING IN SIND.

I attach the result of an interesting Snipe Shoot which took place at Puran near Makle, Lower Sind. It is understood to be a record for Sind, but there is no confirmation of this.

The guns were Mr. W. M. Petrie of Ralli Bros., Mr. K. A. Lister Kaye, R.A.F., and myself. The going was very hard and the wind a northern one and strong. The shoot began at 10 a.m. and finished at about 5-15 p.m. with breaks as shewn below.

The first stop was for about 20 minutes, the second for about 45 and the third for 15.

The Snipe were all in excellent condition and the main proportion Fantails with a few Jacks, six " Painters" were also included in the bag as we understood Mr. Stuart Baker classifies this in his " Game Birds " as a Snipe although doubtful.

307 Head of Snipe.

	1st Stop 11 *a.m.*	*2nd Stop* 1-30 *p.m.*	*3rd Stop* 4 *p.m.*	*Final.*	*Total.*
Mr. Petrie ..	19	31	23	27	100
,, Kaye ..	17	44	24	22	107
,, Rubie ..	18	37	22	23	100

KARACHI,
3rd January 1923.

C. B. RUBIE.

No. XXX.—PLUMAGE DISPLAY BY THE SIRKEER CUCKOO (*T. LESCHENAULTI.*)

Plumage display amongst certain species of birds seems to be sufficiently well known, but it may interest readers to know that I have recently observed the peculiarity in the Sirkeer Cuckoo, a bird of remarkably sober plumage when in repose.

The curious courtship of a pair which I watched the other morning savoured rather of the grotesque ; but it was a revelation of the curious brown and white patchwork effect which such a sober-plumaged bird could produce. The scene was enacted on an open plain, both birds giving vent to curious clicking sounds. But while the hen took short runs along the ground with her head held low the cock would circle round her with drooping wings and outspread tail, a position in which the patchwork patterns were most conspicuous. At the end of each run he would touch the ground with his bill, and then raise it slowly skywards, remaining in that position for a minute or more before repeating the performance. This plumage display continued for about twenty minutes, after which both birds began pruning their feathers as though nothing had happened.

GHAZIPUR,
7th June 1922.

E. H. GILL.

No. XXXI.—NOTES ON TURTLES.

For some time I have been trying to collect some specimens of giant turtles that visit this coast yearly for a period of one to two months during apparently the period of oviposition as I have always heard from the natives of their immense size which I have found it difficult to credit. I have been stationed in Quilon on and off since 1906, and was at one time here for nearly five years consecutively but have never once seen a specimen. About three weeks ago one came up on the beach very close to my bungalow during the night and laid 190 eggs in the sand, on examining the place next morning I found the size of the excavation very large, some six feet in diameter. I got one of the eggs, the rest being taken by some fisherman. The egg was round like a tennis-ball, with the exception of an indentation of one inch square, white, measuring $3\frac{1}{4}$ inches in diameter, the covering was not of shell but composed of thick skin flexible to the touch. I had men on the lookout for the reptile's return or others, but unfortunately whilst away in camp another, or the same one, came up on the beach and was caught and killed and eaten. Again yesterday morning one was brought me on a cart alive which had been caught out at sea in a net specially prepared for the purpose. It was of an immense size just over seven feet from end to end. I had it taken off the cart with the help of 12 men and even then with great difficulty, as it was found almost impossible to keep the animal still. I directed it to be taken round to an office here for some Europeans to see as I had to go out all day, meaning to have it photographed and properly measured on my return, as I fancy it had been injured too much to survive long. However the coolies apparently got a better offer of Rs. 60 for it in my absence and by the time I was able to trace it, it had been killed and cut up. Having myself seen this specimen I was able to look it up and find its description tallies very nearly with that of the *Sphargidæ* which includes a single genus and species, the well known Leathery Turtle. (*D. coriacea*). It differed from all other Chelonians by having its carapace formed by ossifications of the skin only, the bony deposits appeared to be arranged like mosaic with several longitudinal ridges of larger osseous tubercles; the limbs were something like those of other marine turtles, all destitute of claws, the two front ones narrow and fin shaped and quite smooth with a black hard surface, the two back ones very flat and broad.

After making many enquiries on the subject, the fishermen of the coast here tell me that up to 25 years ago these large turtles were quite common here and during this period of the year some forty odd would be caught annually either when attempting to come ashore or from specially prepared nets out at sea. They say that for the last 7 to 10 years they are only seen occasionally and some two or so caught annually. They appear to frequent the outskirts of the Tangacheri reef some two miles away, which extends some distance to the south-west and west of the point and along the coast to the Northward, 8°54′ N. Lat. and 76°37′ E. Long. Whilst referring to some of your Journals for information, I came across a description of the Giant Tortoise, and would draw your attention to the measurements given (in Vol. xxvi, No. 3, p. 861) regarding the shell of a specimen which is said to measure 46′5″ in length and weigh 593 lbs., there is obviously some mistake here, as the specimen of turtle I saw measured over 7′ over all, and I should say by the number of men it took to handle it must have weighed at least 600 lbs. alive.

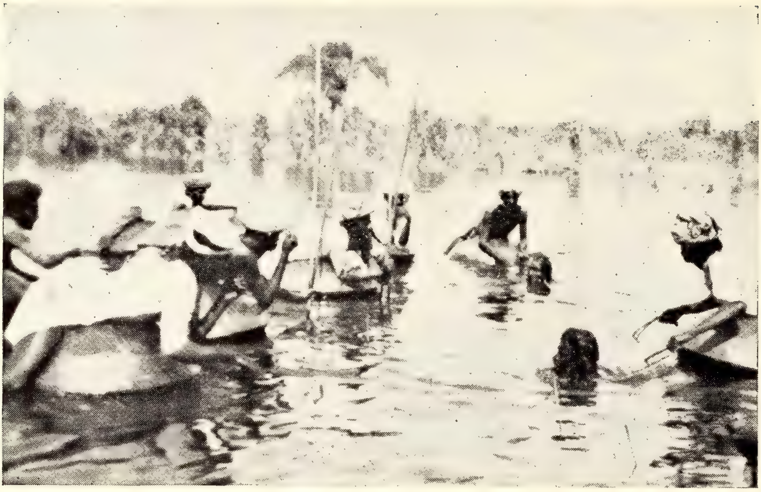
QUILON, TRAVANCORE, T. H. CAMERON,
SOUTH INDIA. D.S.P., QUILON.

[The correct length was 46·5 *inches* as pointed out in the errata published for Volume XXVI.—EDITORS.]

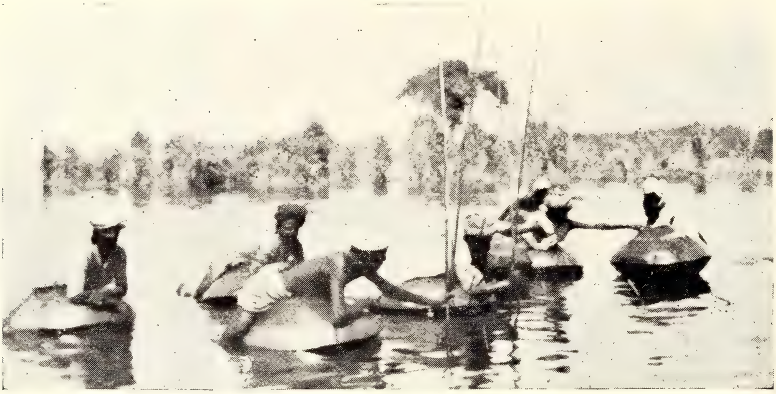
No. XXXII.—"CATCHING CROCODILES."

(*With a plate.*)

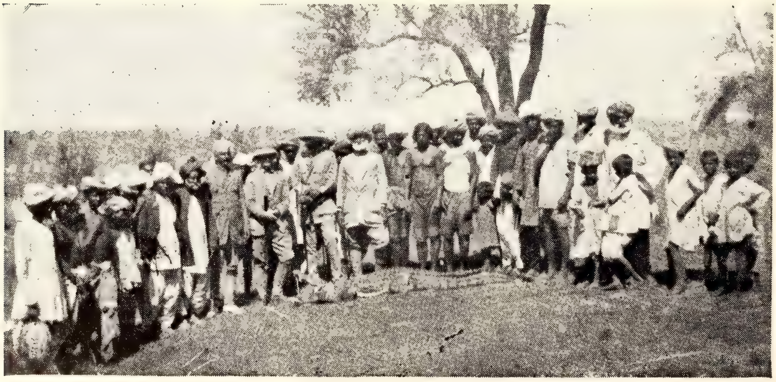
To the popular mind, there are probably few more repulsive animals than the crocodile, and, though his habits may be regarded as essentially lazy, by reason of his passion for basking in the sun, he is usually considered aggressive enough



No. 1.
THE MUGGER "HELD" BY BAMBOO POLES.



No. 2.
THE DIVERS ABOUT TO DESCEND TO ATTACH THE ROPE.



No. 3.
THE CATCH.

when the chance of a meal offers. Hence many will find difficulty in accepting an account of a crocodile catch as carried out by native fishermen in a jheel on the borders of Sind and Rajputana.

In contradiction to the popular theory, it is first necessary to appreciate the fact that the crocodile is a timid creature, and is by nature easily terrified by human beings, witness the difficulty invariably experienced by the crocodile hunter in getting near enough to his victim for a shot, and the necessity of his having as a rule to resort to painful stalking. The Sindhi fishermen assume that the crocodile becomes so frightened by the presence of a number of men moving and splashing about on the surface of the water, that instead of fighting or attempting to escape, he becomes intent on squirming his way down into the mud. And the story of a catch recently witnessed shows that this assumption is not without justification.

Whether this method is peculiar to the district it would be interesting to know. The men were " mounted " on floats of copper, on which they lay face downwards on their stomachs, leaving their arms and legs free for purposes of propulsion. There were some two dozen taking part in the catch, and they were provided with large-meshed fishing nets, 4 bamboo poles and some 30 feet of light rope. As soon as a ' Croc ' had been sighted on a bank and had slipped into the water, a number of men laid a ring of nets round the area in which he was likely to be lying. Others then proceeded to probe the mud with reeds, until the animal's back was felt. Preparations were next made to " fix " him with the bamboo poles, and meanwhile one of the men actually slipped off his float and was standing in the 5 feet of water only a few yards from the located mugger—But the brute made a sudden bid for liberty, without in the least upsetting the composure of the man in the water, and his progress could easily be followed by the trail of bubbles which rose to the surface. His direction was towards the shallows, but no sooner had his head appeared above water then he plunged over backwards, redoubled on his tracks, and made his way round the ring of men who had been heading him off. His movements were followed as before, and he had even gathered sufficient courage to break through two rings of nets in his course. But more nets were being rapidly spread out ahead of him and he eventually settled down after having travelled some forty yards. When the process of prodding the mud had again disclosed his position, the four bamboo poles were brought up, and one of the older hands of the party began gently feeling in which direction his head was lying. He then fixed the poles into the mud, one on either side of the croc's neck and body, (the poles can be clearly seen in the photos) and two men proceeded to dive down into the seven feet of water to investigate. As their victim seemed in no wise disposed to move, one of the divers took the end of the rope down on his next descent (see the second photo) and while his companion tickled the croc's stomach, he slipped the rope under and fastened it securely. The tops of the nets were then drawn round the spot where the croc was lying. In the photos the lines of the nets can be detected by the sticks to which they were attached, and after the poles had been removed, nothing remained but to haul the catch ashore. As soon as he struggled, the croc became completely tied up in the nets, and some 10 or 12 men on their floats, by paddling backwards with their feet, were able to pull him sufficiently near land to hand over the rope to the men waiting on shore. The brute was quickly despatched by two rounds of 12 bore shot—the natives usually hack their victim to death with their small axes,—and on being extricated from the nets was found to measure eight feet.

The natives do not hunt the crocodile for purposes of sport, but purely as a defensive measure to protect the fish.

MIRPURKHAS, SIND,
7th November 1922.

J. MONTEATH, I.C.S

No. XXXIII.—Mr. BHANAGAY'S SNAKE CHART.

My attention has been drawn to a chart for the identification of harmless and poisonous snakes, compiled and being offered for sale for use in hospitals and dispensaries, by one Sub-Assistant Surgeon Bhanagay, Amraoti, C. P. The first thing to attract attention is that all the figures used to illustrate his text have been cribbed from the chart compiled by the Bombay Natural History Society and now sanctioned by Government for use in Military and other hospitals. No permission has been given by our Society for the use of these figures, and no acknowledgments are made as to the source from which they have been taken.

A study of Mr. Bhanagay's text shows that he has freely cribbed from the text of our Society's chart. Where he departs from this, he almost invariably falls into error. For instance the anal shield of Russell's Viper (*Vipera russelli*) is stated to be divided, and the sea-snakes (*Hydrophiinæ*) are shown among those snakes that have broad ventral shields! But there are other glaring errors.

In order to test Mr. Bhanagay's knowledge of the subject, I wrote a letter to him which I asked a friend of mine to sign, and submitted a poisonous snake *viz., Ancistrodon hypnale*, from Ceylon, to him for report. I pointed out that according to his chart the specimen appeared to be harmless, but I would like his confirmation of this, and also would like to know the name of the snake, which I told him had been killed in my compound in Karachi. In due course Mr. Bhanagay sent the following reply:—

"Dear Sir,

As far as I could make out the specimen seems to be a common tree snake—*Dipsadomorphus gokool*."

Mr. Bhanagay therefore failed to recognise this very perfect specimen as a pit viper, or a poisonous snake at all, but pronounced it a harmless species. *Dipsadomorphus gokool* I may mention is only found in Eastern Bengal, Assam and Burma, many hundreds of miles from Karachi. It has not even a superficial resemblance to *Ancistrodon hypnale* and the lepidosis of the two is strikingly different, *gokool* has 21 scale rows, *hypnale* 17. In *gokool* the vertebrals are enlarged, in *hypnale* not. In *gokool* the ventrals number 224 to 232, in *hypnale* 136 to 157 (149 in this specimen). In *gokool* the subcaudals number 87 to 101, in *hypnale* 30 to 47 (41 in this specimen). In *gokool* there are eight supralabials, the third, fourth and fifth touching the eye, in *hypnale* there are seven, none of which touch the eye. In *gokool* there is no loreal pit, in *hypnale* there is a pit. These are only some of the more important differences. It is obvious that Mr. Bhanagay has not a very profound knowledge of Indian snakes, and our Members would be well advised not to consult his chart, which is misleading.

KARACHI,
23rd December 1922.

F. WALL,
COLONEL, I.M.S.

[The Inspector-General, Civil Hospitals, Central Provinces, has, on our bringing this matter to his notice, advised Mr. Bhanagay to withdraw his misleading chart.—EDITORS.]

No. XXXIV.—SNAKES AND LEECHES.

I was specially interested in the note in this journal (Vol. XXVIII, p. 557) by Mr. Kinloch. The only other instance known to me of leeches attaching themselves to snakes was mentioned in my article on the Copper-headed Rat Snake (*Coluber radiatus*) in this journal (Vol. XXIII, p. 209). In my case the leeches were aquatic, some species of horse leech I presume. I found two, bloated with blood, in the mouth of the specimen referred to in Assam. Mr. Kinloch's observation concerns a different leech, that very disagreeable denizen of upland regions throughout India from the Himalayas to Ceylon that is so common in the rains.

KARACHI, F. WALL,
18*th November* 1922. COLONEL, I.M.S.

No. XXXV.—COBRA GOING DOWN A HOLE TAIL FOREMOST.

A few days ago I was walking along a path with the Maharaj Kumar of Cutch when we saw a cobra a few feet in front of us. Directly it saw us it made for a hole close by and went down *tail first.* It may not be unusual but I have never seen a snake go down a hole with its reverse gear in and I was glad to have a reliable witness with me. It recalls the action of the cobra in "As wise as a serpent" in the Lays of Ind. Probably Aliph Cheem had never seen a cobra act as described in his Bath-room Epic but it certainly made an amusing story.

BHUJ, CUTCH, E. O. BRIEN,
8*th September* 1922. LT.-COLONEL.

No. XXXVI.—NOTES ON A LARGE MONITOR (*VARANUS SP.*) IN GHAZIPUR.

While out looking for nests this morning in some long grass, my wire-haired terrier began to bark furiously, and on going to investigate I found that he had a large Iguana lizard at bay. The dog was running round in circles trying to grab the reptile by the back of the throat but the latter kept turning too and presenting its hind quarters to the dog with its tail drawn round at almost a right angle to its body. Every time the dog got too close the tail would slash round and strike the dog a resounding blow. This battle raged for about ten minutes, and each time the dog was hit and drew back the reptile would get a couple of feet nearer a hole in a bank into which it finally disappeared. While the reptile fought it gave vent to loud hisses which seemed to be caused by the inflation of a sort of bag under the throat.

I believe that these lizards are harmless, but the local natives believe that a slash from the tail causes sores of a virulent type, which may sometimes prove fatal. Is there any foundation for this belief ? Certainly the reptile did not seem to be very perturbed when attacked by the dog, and seemed to have ample confidence in his method of defence.

I have seen these reptiles rob nests on several occasions, especially nests on, and in the vicinity of water ; and on one occasion saw one raid a squirrel's nest with four young. After raiding the nest it disappeared into a hole in a tree trunk carrying two of the young in its mouth, and one in each hind claw, followed behind by both the parents making a dreadful noise.

They are also expert swimmers, and I have watched them fishing on several occasions. They emulate otters by catching fish beneath the surface, and then coming out on land to devour it.

GHAZIPUR, U.P., E. H. GILL.
11*th September* 1922.

[Though generally believed to be poisonous the Monitors (*Varanidæ*) are harmless reptiles. There are no poisonous Lizards known from India. The only poisonous Lizard known to science is the American Holoderm.—EDITORS.]

No. XXXVII.—OBSERVATIONS ON THE NESTING OF *EUMENES CONICA.*

On 23rd August 1922 when I went home from College in the evening I found that a *Eumenes conica* was making a considerable buzzing noise in my study. On close observation I found that she had lately finished one cell and was about to start constructing another. I felt myself very fortunate to obtain an opportunity of observing very closely the nesting of the wasp.

It was 4-45 p.m. when she brought the first pellet of wet mud, prepared into very fine consistency, and spread it on the floor close to the finished cell. The three previous cells were constructed on a wooden plank in an open wall almirah in such a way that the plank served as the ground floor and the books on the plank as a support on one side. The wasp took 2 to 3 minutes to make a trip and at each one she would bring a little mud and spread it out in a curve with the help of the flat and long mandibles and maxillæ and the fore tarsi. She would apply the fore tarsi from outside and the buccal appendages from inside just as a potter would use both the palms of his hands in shaping an earthen vessel. The shaping of the nest would not take her more than one minute and again she would go out and get another pellet. Each time she would first alight on the completed cell and examine with the antennæ whether the new cell was undisturbed. In this way she brought more and more mud, working it all up into a wall rising from the floor and curving inwards till there was left a small round mouth. Afterwards she put on a raised rim on the mouth and thrust in her abdomen to attach one egg at the roof of the cell. The wasp each time went out by one window and invariably returned by the same. She required in all 17 pellets of mud of the size of a small pea to construct the entire cell and this she finished by 6-26, the same evening, thus taking exactly one hour and 41 minutes. At 6-26, immediately after she finished up the cell, she thrust in her abdomen to deposit the egg and remained in that posture for a couple of minutes and then flew away. She did not return on that day as it was getting dark outside.

As I was very much interested in watching the entire process, I did not lose any time next morning in carrying on further observations on the nest. At 6-40 a.m. on the following day, *i.e.*, 24th August, to my intense surprise the wasp returned, not alone but with a fairly big greenish caterpillar. She as usual alighted first with the burden on the neighbouring cell and, seeing that everything was alright, thrust the caterpillar slowly into the new cell, waited for some time, and then flew away. A second caterpillar was brought at 6-45, the third at 7-8, the fourth at 8-0 and the fifth at 9-10.

The thing that struck me most, and I believe it would strike many who attribute all the actions of insects to some fixed instincts or tropic reactions, was that the female wasp returned the next morning at 6-40 with a caterpillar. This shows clearly that the wasp remembered that she left the nest the previous evening in an unfinished condition. Ordinarily what I expected was that the wasp would come next morning as usual and finding that the cell was incomplete would set out to complete it. But the power of remembrance which was evinced was simply wonderful and suggests that it is something more than mere instinct.

At 9-12, *i.e.*, two minutes after the last caterpillar was deposited, the wasp brought a pellet of mud and began to close the cell, which took her about 5 minutes to do. On the previous evening, when the wasp deposited the egg and went for repose during the night, I slowly thrust in a piece of paper below the cells and this naturally left a crack or space between the cells and the paper. The wasp after closing the cell began to inspect the entire structure all round. She discovered the crack and immediately began to repair it. As usual she brought pellets of mud and having closed the crack flew away for good.

A grub emerged from the egg on 26th August and by 29th August it had attained a fairly big size, consumed practically all the food, but unfortunately it afterwards proved to be not the larva of the wasp but a Modellid grub. The parasitic Modellid beetle emerged on 28th September 1922.

During the night of 23rd August the beetle must have parasitised the egg. This beetle took 35 days to complete its life cycle. The wasp had constructed 4 cells out of which three met with some mishap or other and only one reared the wasp completely. Of the three cells one contained the dead grub, the second gave 10 Tachinid flies, and the third one Modellid beetle.

The wasp took 1 hour and 41 minutes to build the cell and 2 hours 38 minutes more to store 5 caterpillars and to cap it. Thus 4 hours and 19 minutes were required for preparing, storing and caping one cell completely, while Mr. Lefroy writes in his "Indian Insect Life" on page 212 that the complete making, storing and closing of a cell in *E. conica* occupies a day.

The wasp came at almost regular intervals so long as she was constructing the cell, but when engaged in procuring caterpillars her visits were very irregular, the interval sometimes being more than one hour. All the five caterpillars on close examination were found to be of one kind and presumably of the genus *Acontia.*

Agricultural College, Nagpur,
The 18*th Oct.* 1922.

J. L. KHARE.

No. XXXVIII.—TROUT FOOD IN KASHMIR.

(*From the Journal of the Fly-Fisher's Club.*)

An extremely interesting little collection of "trout-food" was sent from India by F. J. Mitchell, Esq., from various lakes and streams in Kashmir. A feature of this collection is that, with one exception, and that a fly recently described from the same district, every item in the collection represented a species new to science.

To the fly-fisherman it will be of some interest to learn that there is present in Kashmir a caddis-fly very closely allied to our grannom, *Brachycentrus subnutilus.* Quantities of this fly, though in a very digested condition, were present in an autopsy, and from the construction of the abdomen of the female insect there is little doubt that it carries the green egg sac just as our grannom does. A few cases were also included and these conform to the regular feature of the genus in having quadrilateral cases, composed apparently of fragments of weeds Free larvæ were also found belonging to the *Rhyacophilidœ* and *Hydropsychidœ* families of caddis-flies. Amongst the adult flies were undescribed species of *Agapetus* and *Apatania,* together with two flies, one belonging to the *Sericostomatidœ* and the other to the *Limnophilidœ,* which may even require new genera to fit them into the scheme of classification.

By far the most interesting insect from the entomological point of view was a dipterous fly unlike anything that has ever been described. It created somewhat of a sensation at the Natural History Museum and was a subject of great interest at a meeting of the Entomological Society of London, where it was exhibited. It is now being described by one of the leading authorities on the Diptera, Mr. F. W. Edwards, who has found it necessary to create a new family to include this extraordinary insect.

Amongst the collection were also a new species of grass-hopper, new species of fresh-water shellfish, parasitic worms, crustaceans, water beetles, crane flies (daddy long-legs), stone flies, *Ephemeridœ, Chironomidœ* larvæ and adult dipterous flies. It was, in fact, one of the most interesting of little collections that has ever reached this country, and is a good example of the valuable contribution to science that the fly-fisherman can make.

ELECTION OF NEW MEMBERS.

The election of the following 83 members since the last publication of the Journal took place at a meeting of the Committee held on the 5th December 1922:—Capt. M. L. Barrett, Saugor, C. P.; Mr. F. Dobson, Panposh, B.N.Ry.; Major A. L. Sheppard, I.M.S., Bombay; Capt. T. N. C. Nevill, England; H. H. The Raja Ram Singh, Chamba, Punjab; Mr. J. E. Davy, Bombay; Capt. R. H. Stable, Bombay; Count Bobrinskoy, F.R.G.S., etc., England; Lt.-Col. W. Haywood-Hamilton, C.I.E., C.B.E., D.S.O., F.R.C.S., F.Z.S., Bombay; Lt. G. H. Osmaston, M. C., R. E., Mussoorie; Mr. Harold M. Bazett, Tharrawaddy; Mr. C. W. Burnside, Bombay; Dr. W. Dunlop, Baghdad; Mr. M. H. Clarke, Jakhlabandha, Assam; Mr. M. O. Daly, Jakhlabandha, Assam; Mr. R. Macdonald, Misa, Assam; Lt.-Commdr. C. T. Howard White, R.N., England; Raja Prabhatchandra Barna, Gauripur, Assam; Col. F. J. Marshall, C.B., C.M.G., D.S.O., England; H. H. Mir Ali Nawazkhan, Khairpur Mess, Sind; Mr. R. P. Whitehead, R. A. F., Ambala; Dr. W. St. T. Davis, Dwarbund, Cachar; Mr. W. E. Gladstone-Solomon, Bombay; Capt. M. Noel Hill, Simla; Capt. H. G. Gregory Smith, Simla; Mr. E. Ewart, Kalthurity, S.I.; Capt. H.H. Maharaja Umaid Singh Bahadur, K.C.V.O., Jodhpur; Mr. F. W. F. Fletcher, Pykara, Nilgiris; Mr. W. D. MacBey, Rajahmundry; Capt. C. G. Crondace, Bombay; Mr. Hugh Keene, Ellore; Major T. S. Paterson, M.C., Saugor, C.P.; The Rev. Mother Superior, Convent High School, Mhow, C.I.; The Mess President, Officers' Mess, 122nd Rajputana Infantry, Thal, N.W.F.P.; Lt. V. R. Wright-Neville, Multan; Lt.-Col. R. A. Bryden, D.S.O., R.A.M.C., Kalabagh, Mianwali; Mr. N. S. Bor, I.F.S., Nowgong, Assam; Mr. A. G. Edie, I.F.S., Poona; Mr. C. Paterson, Vandiperiyar, S.I.; Mr. N. E. Parry, I.C.S., Tezpur; Mr. R. C. Elers, Peermade, S.I.; Mr. R. H. Paddison, Almora, U. P.; Major T. W. Corbett, M.C., Poona; Prof. P. R. Awati, I.E.S., Bombay; Capt. R. Critchton, Saugor, C. P.; Mr. A. F. Perrott, Hangu, N. W. F. P.; Mr. H. G. Waterfield, Indore, C.I.; Mrs. L. J. Martin, Baroda; Mr. Ambalal Sarabhai, Ahmedabad; Mr. C. R. Hill, Madras; Mr. E. T. D. Ferguson, Tonk Raj, Rajputana; Mr. H. A. V. Maynard, Lahore; The Mess President, 59th Royal Scinde Rifles, F. F., Hangu; Mr. G. P. Farley, Vandiperiyar; Mr. W. S. Rowson, Vandiperiyar; Mr. J. S. Wilkie, Peermade, S. I.; Mr. J. H. Cantlay, Vandiperiyar; Mr. R. E. Macpherson, Sholapur; Mr. M. F. Bridge, I.F.S., Salem; The Deputy Director of Agriculture, Myingyan Circle, Myingyan; Major G. Crastor, Risalpur; Mr. Malcolm M. Crawford, Shikarpur, Bengal; Mr. E. H. Weigall, Rangoon; Capt. G. Hope Sworder, Taiping, Perak, F. M. S.; Major J. Taylor, D.S.O., I.M.S., Bombay; Dr. N. Hamilton Fairley, Bombay; Mr. J. B. Greaves, Bombay; H. H. Colonel Sir Ifti Khor Ali Khan, K.C.I.E., Nawab of Jaora, Jaora, C.I.; Capt. Kumar Birindra Singh, A.D.C., Patiala; The Librarian, Lucknow University, Lucknow; The Honorary Secretary, Nasirabad Club, Nasirabad; Dr. R. W. Fisher, M.D., Belgaum; H. H. Rajaram Chhatrapati, Maharaja of Kolhapur, Kolhapur; Mr. D. S. Alakhachar, Rajkot; Mr. J. C. Dyer, Gangtok; Mr. T. A. M. Hill, Bombay; Mr. W. Petrie, Karachi; Major C. B. Rubie, Karachi; Mr. J. L. Bernard, Bombay; Mr. J. R. Abercrombie, Bombay; Mr. W. S. Inman Vandiperiyar; Mr. H. R. Dogra, Bezwada; Capt. G. B. Williams, Bombay.

CONTRIBUTIONS TO THE SOCIETY'S MUSEUM SINCE 22ND MAY 1922.

There have been numerous contributions to the Society's collections, we are glad to report, since we last issued a list, but financial considerations and a spirit of retrenchment have decided the Committee not to publish these lists in extenso in future. We have to thank all our contributors, but would specially

mention here Mr. Gordon Hundley, Mr. E. H. Gill, Mr. J. P. Mills, Col. F. M. Bailey, Mr. Cyril Hopwood, Mr. D. F. Stileman, Mr. C. R. Beadnell, Mr. A. P. Kinloch, Mr. J. E. B. Hotson, Mr. Chas. McCann, Mr. M. M. Mackenzie, Mr. P. M. R. Leonard, Major Lawrence, Mr. H. W. Wells, Major F. C. Fraser. Capt. J. G. P. Drummond and Mr. W. D. Cumming.

ANNUAL MEETING.

The annual meeting which should have been held in February had, owing to unforeseen reasons, to be postponed and was held on April 26th.

At this meeting Mr. S. H. Prater, the Assistant Curator of the Society's Museum, gave an account of his progress in England with the preparation of the specimens for the Natural History Section of the Prince of Wales' Museum, Bombay, and also of his visit to several important Natural History Museums in England and Scotland.

A collection of mounted specimens prepared in England at Messrs. Harwood & Co.'s studios was on view in the galleries of the Prince of Wales' Museum, together with a series of mounted animals prepared in the Society's Rooms since Mr. Prater's return.

NOTICE.

Members and subscribers are advised that it is proposed shortly to issue a supplement to the Handlist of the Birds of the Indian Empire, by Mr. Stuart Baker, containing the necessary addenda and corrigenda.

R. A. SPENCE,
Honorary Secretary.

6*th April* 1923

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506.54

THE
JOURNAL
OF THE
BOMBAY NATURAL HISTORY SOCIETY.

EDITED BY

R. A. SPENCE, F.Z.S., and S. H. PRATER, C.M.Z.S.

SMITHSONIAN INSTITUTION
SEP 7 1927
NATIONAL MUSEUM

VOL. XXIX, No. 2.

Date of Publication, 25th August 1923.

Price to Non-Members	*Rs. 12-0-0* *or 16s.*

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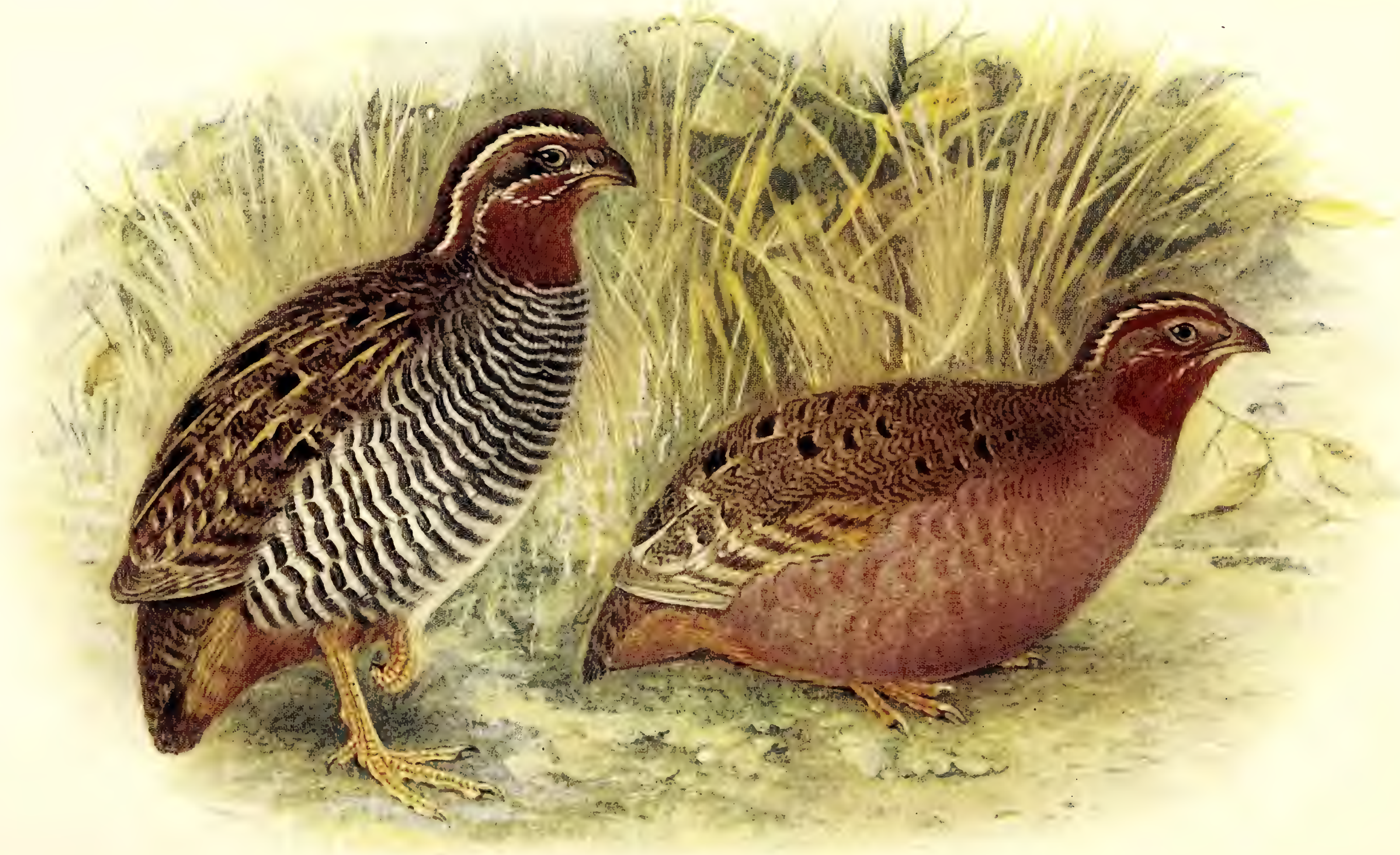


male. female.

THE JUNGLE BUSH-QUAIL
Perdicula asiatica.
$\frac{4}{5}$ natural size.

JOURNAL

OF THE

Bombay Natural History Society.

AUGUST 1923. VOL. XXIX. No. 2

THE GAME BIRDS OF INDIA, BURMA AND CEYLON.

BY

E. C. STUART BAKER, F.L.S., F.Z.S., M.B.O.U., C.F.A.O.U.

PART XXXV.

(*With a plate.*)

(*Continued from page* 8 *of this Volume.*)

GENUS PERDICULA—Hodgson, 1837.

The Genus *Perdicula* contains but one species, *Perdicula asiatica*, which is confined to the Indian Peninsula. This species contains two forms which grade the one into the other and which to some slight extent overlap in their habitats though never, as far as is known at present, in their actual breeding places. These two forms appear to have become somewhat differentiated not so much on account of their geographical distribution as on account of the different kinds of country in which they breed. *P. a. asiatica* breeds in places fairly well covered with jungle of some kind whereas *P. a. argoondah* breeds in rocky open uplands, or bare plains. This seems to have encouraged a paler type of colouration in the latter bird, suited to the sandy or rocky soil in which it dwells and blending better with the scanty dried grass in which it places its nests. Intermediate birds are not uncommon and some naturalists would infer from this that the two forms are good species and these individuals hybrids, to me they appear to be merely intermediate specimens occurring in intermediate country and to form the link between two sub-species which are probably of very recent origin.

The genus and species is peculiar to the Indian Peninsula and agrees in many respects more clearly with the true Partridges than with the Quails. In size they are small, the bill is short and thick and the culmen very convex ; the wing is short and rounded, the first primary is equal to the seventh or eighth and the fourth is longest; the tail is about half the length of the wing and consists of 12 feathers; the tarsus is about as long as the middle toe and claw, and is armed in the males with a blunt tubercular spur. The sexes differ in plumage.

KEY TO SUB-SPECIES.

A. Breast barred black and white.
- *a.* Supercilium and line between cheeks and throat conspicuous; buff or rufous barring of upper parts lacking. . . *P. a. asiatica*, ♂
- *b.* Supercilium and cheek-stripe inconspicuous or absent; back barred with buff or rufous . . . . *P. a. argoondah*, ♂

B. Breast dull vinaceous or rufous lilac.
- *c.* Inner webs of primaries brown throughout . . . . *P. a. asiatica*, ♀
- *d.* Inner webs of primaries mottled or barred with buff . . . . *P. a. argoondah*, ♀

PERDICULA ASIATICA ASIATICA.

The Jungle Bush-Quail.

Perdix asiatica. Lath., Ind. Orn. ii, p. 649, (1790), (India).

Perdix cambayensis. Temm., Pl. Col. v, p. 41, (1828); Franklin, P. Z. S., 1831, p. 123, (Calcutta and Benares).

Coturnix pentah. Sykes, P. Z. S., 1832, p. 153, (Deccan); Gray, Ill. In. Zool., ii, pl. 45, (1834); Sykes, Trans. Zool. Soc., ii, p. 19, pl. iii, (1841); Adams, P.Z.S., 1859, p. 186, (Kashmir).

Perdicula rubicola. Hodg., Beng. Sport. Mag. ix, p. 344, (1837).

Coturnix cambaiensis. Gray, List of B., pt. iii, p. 38, (1844).

Perdicula rubicolor. Hodg., in Gray's Misc, p. 85, (1844).

Coturnix rubiginosa. Gray, Gen. Birds, iii., p. 507, (1846).

Perdicula asiatica. Adams P. Z. S., 1858, p. 504, (W. Himalayas); Irby, Ibis, 1861, p. 236, (Oudh and Kumaon); Gould, B. of A., vii., pl. iv, (1863); Holdsw., P. Z. S., 1872, p. 470, (Ceylon); Hume, Nests and Eggs, p. 546, (1873); Lloyd, Ibis, 1873, p. 415, (Kattiawar); Hume, S.F., vii, p. 158, (1878); David. & Wend., ibid, p. 87, (1878), (W. Deccan); Ball, ibid, p. 225, (1878), (Ganges to Godavery); Hume & Marsh., Game-B., i, p. 109, (1879); Butler, Cat. B. of Sind, p. 55, (1879); id, B. of Bom., p. 69, (1880); Vidal S.F., ix, p. 77, (1880), (S. Konkan); Legge, B. of Cey., iii., p. 752, (1880); Butler, S. F., ix., p. 422, (1880), (Bombay); Reid, ibid, x, p. 63, (1881), (Lucknow); David., ibid, p. 317, (1882), (W. Khandeish); Davis., ibid, p. 411, (Mysore and Nilghiris); Swinh. & Barnes, Ibis, 1885, p. 131, (Central India); Taylour, S.F., x., p. 463, (1881), (Mysore); Oates ed. Hume's Nests & Eggs, iii, p. 440, (1890); Grant, Cat. B.M., xxii, p. 198, (1893); id, Handb. Game-B., i, p. 153, (1895) ; Butler Jour. B. N. H. S., x, pp. 285, 312, (1896), (Ceylon); Oates, Man Game-B., i, p. 112, (1898), Blanf., Avifauna B.I., iv, p. 118, (1898), Harington, Jour. B. N.H.S., xii, p. 410, (1899), (Deccan); Oates Cat. Eggs. B.M., i, p. 41, (1901); Jesse, Ibis, 1893, p. 153, (Lucknow); Ferguson, Jour. B. N. H. S., xvi, p. 4, (1904), (Travancore) ; Ward ibid, xvii, p. 944, (Kashmir); Cockerill, Avi. Mag., vii, p. 234, (1909); King, Jour. B. N. H. S., xxi, (1911), (Saugur and Damoh Dist.); Whitehead, ibid, p. 168, (Sehore); Hingston, ibid, xxvii, p. 570, (1921), (Dharmsala).

Perdicula cambayensis. Jerdon, B. of I., iii, p. 581, (1863); Ball, S.F., ii, p. 437, (1874), (Chota Nagpur); Butler, ibid, iv, p. 6, (1876), (Mt. Aboo); Fairb., ibid, iv, p. 262, (1876); (Khandala, etc.)

Perdicula argoondah. Gould (nec Sykes) B. of A. vii, pl. 5, (1863).

Perdicula cambaiensis. Blyth, Ibis, 1867, p. 160; Beavan, ibid, 1868, p. 386, (Manbhum, Umballa, Punjab).

Vernacular names.—Lowa, (Hin); *Juhar*, (Manbhum); *Auriconnai*, (Santhali); *Girza-pitta*, (Tel.); *Kari-Lowya*, (Can.); *Chota Batir*, (Saugur).

Description, adult male.—Forehead, supercilia, chin, cheeks, anterior ear-coverts and throat rufous chestnut; posterior ear-coverts brown; a broken white line above the supercilium; crown brown, bordered with black and more or less barred with the same; sides of neck, back, rump, upper tail-coverts fulvous brown, with narrow wavy black bars and the back also with narrow whitish shaftlines; scapulars, inner wing-coverts and inner secondaries brown with bold black bars, some rufous barring and creamy central streaks; bastard wing, outer coverts and quills brown with rufous bars on the outer webs; tail brown with black-edged buff bars; below from throat barred black and white; vent, thighs and under tail-coverts rufous, vinous-rufous or rufous buff.

The breast is pure black and white only in old birds whilst in younger ones the whole lower surface is more or less suffused with vinaceous and the crown also is more or less rufous.

Very old birds often lose the pale streaks on the back.

Colours of soft parts.—Iris light to dark brown; bill horny or slaty black, often reddish horny at the base, this colour occasionally covering as much as two-thirds of the culmen; legs and feet dull yellowish, yellowish orange to light reddish-brown.

Measurements.—Total length about 165 to 175 mm.; wing 77 to 92 mm., generally between 82 and 88 mm.; tail 35 to 40 mm; tarsus 28 to 29 mm.; culmen about 10 mm. Weight "2 ozs. to 2·85 ozs." (Hume).

Adult female.—Above like the male but without the pale central marks to the feathers of the mantle; less boldly and handsomely marked on the scapulars and inner secondaries; the whole of the lower parts are dull vinaceous or lilac rufous, generally a little darker and more rufous on the throat.

Colours of soft parts as in the male.

Measurements average a little less than in the male except the tail which is even longer. Wing 78 to 86 mm. ; tail 38 to 41 mm. ; tarsus about 28 to 29 mm. ; culmen barely 10 mm.

Young birds are like the females but have little or no rufous on the head or throat ; the crown and back have very narrow white central streaks and the wings of young males are like those of the adult male with broad buff streaks, which are absent or obsolete in young females; the whole lower parts are a paler, more lilac rufous and the chin, throat and sides of the head are profusely streaked with creamy white; the breast is sparsely marked in the same way, and, in some cases, the streaks again appear on the posterior flanks.

Colours of soft parts.—Iris pale bluish brown, bill paler than in the adult, legs paler and often tinged with fleshy.

The chick in down has the head rufous brown with very broad fulvous white supercilia from the nostrils to the nape ; lores and a line under the eye dark brown ; chin, cheeks and sides of head and neck rich fulvous mottled with brown; when the feathers appear, those of the back, scapulars and inner wings are pale rufous, with white shafts, terminating with broad fan-shaped white spots, edged with black ; lower parts dull fulvous streaked with white on throat and breast.

The first tail feathers are rufous barred with blackish.

Distribution.—The Jungle Bush Quail is found in suitable well-wooded localities from the lower ranges of the Himalayas to Ceylon. Ward reports it from the outer ranges of Kashmir, and Hingston says that it is common at Dharmsala up to about 4,000 feet. It has not been found in Sind but is common in parts of Jodhpore and the Aboo Hills whence it extends throughout the Western Ghats and Travancore to Ceylon where it is found in the hills upto 3,500 feet or perhaps higher. It is common from the Deccan to the South and East of the N. W. Provinces and extends East throughout Behar, Western Bengal, Orissa, the Central Provinces and Northern Madras. Rainey said that he had seen it in Jessore, and I have had it reported from Dacca but both these localities are doubtful and it probably occurs, if at all, only as a straggler in any of the districts of Bengal on alluvial soil. It is common in Chota Nagpur and not uncommon in Gya, the Midnapur and Rajmehal Hills, is occasionally seen in Suri and the Santhal Purgunas and even more rarely in the hilly country of Bankura.

Nidification.—The Jungle Bush Quail is resident and breeds wherever found from the level of the plains up to some 4,000 feet. Hume says even 5,000 feet. Over most of its range it seems to breed from the end of the rains to the end of the cold weather. Thus from the vicinity of Poona I have eggs taken from the 24th. September up to the end of

March, but Harington Bulkley took eggs supposed to have been those of this bird as early as the 14th August in Gujerat, these latter however were probably the eggs of the Rock Bush Quail. Stewart, Bourdillon and others found them breeding in January, February and March in Travancore and Mysore. In the Deccan they breed from October to February, rarely in March, whilst in Orissa, Western Bengal and Behar they apparently lay in March and April.

They make their nest in almost any kind of cover which is thick enough to afford good protection, yet is not too dense or moist. They do sometimes frequent dense evergreen forest for this purpose, but they prefer scrub, bush, deciduous forest or grass land. The nest, for a Game-Bird's, is a quite well-put-together little pad of grass and grass roots measuring four or five inches in diameter with a depression for the eggs between two and three inches across by less than one inch deep. The eggs number four to seven, most often five or six. In colour they range from practically pure white, with the faintest creamy tinge, to a pale cafe-au-lait or light buff. The surface is fine and glossy and the texture very stout and close. Sixty-five eggs average 25.4 × 19.5 and the extremes are: maxima 27.0 × 19.7 and 26.8 × 22.0 mm.; minima 24.1 × 19.3 and 25.0 × 18.4 mm.

Mr. N. F. Cockell, who was successful in breeding these little Quail in captivity, found that the eggs took 18 days to hatch, but in India they apparently take only 16 days. Mr. Cockell's two hens together laid ten eggs in one basket of grass and together sat on them. The cock-birds took no interest in the incubation of the eggs but once they were hatched all the adult birds in the nest, some dozen in number, constituted themselves foster parents of the nine chicks, the cock-birds taking the greater share both in feeding and brooding them. Mr. Cockell comments on the curious fact that though so pugnacious at most times the male birds sank all their differences as soon as the chicks were about and united to do their best to spoil them. The hens who laid the eggs were close sitters, leaving the nest, one at a time, every two or three hours to feed and dust themselves.

They are very close sitters also in a wild state not leaving the nest until almost stamped on. They are, I think, monogamous but two hens may occasionally mate with one cock bird.

Habits.—The Jungle Bush Quail may be found in any kind of dry jungle from thin grass and bush scrub to fairly dense deciduous forests. As Col. Tickell writes :—

> "They prefer stony, gravely places amongst thorny bushes, such as the jujube or ber or tracts of stunted Sal, Assun and Polas (or Dhak); congregating in coveys of eight to a dozen under thickets, whence they emerge of an evening into adjacent fields, meadows and clumps of grass to feed".

In the Western Ghats and Travancore they sometimes frequent evergreen forest in the vicinity of grass or scrub land, but even in this part of India it is the exception to find them out of the drier areas.

The flocks in which they collect must often consist of more than one family for there is no record of any clutch of eggs of more than seven, yet they are often seen in coveys of upwards of a dozen. Even in the breeding season they seem sometimes to gather together in the most sociable manner, and there are several instances on record of two hens sharing a nest, whilst clutches of eggs have been sent to me obviously not all the product of the same bird. Possibly at the beginning of the nesting season, September to November, the birds break up into pairs, for at this season the cock-birds are extremely pugnacious and fight with an energy and persistence in excess of most game-birds. Their natural pugnacity causes them to be much sought after by the natives of many parts of India who catch them and keep them for fighting purposes.

There are many ways by which they are caught. Col. Sykes says that they are generally caught in the same way as are the Grey Partridges and describes this as follows :—

> "A tame one is placed in a small cage covered with strong horse-hair nooses, and carried out in the evening or early morning to the jungle. On arriving at a likely spot, the fowler blows two or three times on the bird in the cage, an act which has the invariable effect of rousing the little captive into fury. It answers every puff with a shrill cry, and in a minute or so goes off into a paroxysm of rage and defiance, screaming and cackling challenges to all comers, in which state it is placed on the ground dancing about in its cage, while the fowler retires behind some neighbouring bush to watch operations. The decoy-bird's calls have been answered probably all round the coppice by the time its master is hidden, and ere long an exceedingly diverting scene, which I have more than once witnessed ensues. One by one the wild cock-birds emerge from the forest........the nearest rushes at it with a charge which would send it rolling off the scene were it not securely pegged to the ground. The bird within and the bird without engage furiously........through the intervening wall, till........ the assailant finds himself fast by the leg in one of the nooses."
>
> " The Bush Quails fight with even greater rancour, and certainly with more clamour, than the Greys, and it is not infrequent to noose every one in the jungle before the trapper has finished this operations in one spot."

Mr. G. Vidal, writing of the Ratnagiri District, says:

> "The natives catch them by night with the aid of torches all huddled together in a compact mass and, dazzled by the glare of the torches, whenever found they fall an easy prey."

This habit of collecting closely together in compact little masses is very typical of the Bush Quail. Even when feeding they keep very close together, all moving simultaneously in a little body in and out of the bushes and grass, keeping within a few inches of one another, all the time pecking, scratching, and hunting for seeds and small insects with the most intense energy and activity. When disturbed they bunch up so close together that a dozen or more will not cover more than a foot or so of ground. They seek safety on foot, still all bunched together, but when almost trodden on, get up with a sharp whirr and scatter in all directions, pitching once more into cover when they have covered anything from twenty to fifty yards. The leader then squats and utters a note which Butler syllabifies as "tiri-tiri-tiri", and within a few minutes they are once more collected.

Their flight is swift and direct and when roused they spin over the tops of the bushes or crops, and then suddenly drop headlong into the bushes or grass. They are not too easy birds to hit for they are so tiny and get up so close to one that if hit too soon they are blown to pieces, whilst if one waits too long they have tumbled out of sight before one has fired.

For the table they are not very good eating, the flesh is white and firm but dry and without much flavour.

PERDICULA ASIATICA ARGOONDAH.

The Rock Bush-Quail.

Coturnix argoondah. Sykes, P.Z.S., 1832, p. 153, (Deccan); id. Trans. Zool. Soc. ii, p. 17, pl. 11, (1841) Burgess; P.Z.S., 1855, p. 31; Hume, S.F., vii., p. 156, (1878).

Perdicula argoondah. Layard, A. M. N. H. (ii) xiv, p. 107, (1854). (Ceylon); Hume, Nests and Eggs, p. 545, (1873); id, S. F., vii, p. 159, (1878); David. and Wend. ibid, p. 87, (1878), (Deccan); Hume and Marsh., Game-B., ii., p. 117, (1879); Butler, Cat. B. of Sind, p. 55, (1879); id, Cat. B. of Bom., p. 69, (1880); id., S. F., ix., p. 423, (1880), (Bombay); Swinh. and Barnes, Ibis, 1885, p. 131, (Central India); Barnes, B. of Bom., p. 313; Oates, Hume's Nests and Eggs, iii, p. 441, (1890); Grant, Cat. B. M., xxii, p. 200, (1893); id. Handb. Game-B. I., p. 115, (1898); Oates, Cat. Eggs, B. M., i, p. 41, (1901); Meinertzhagen, Ibis, 1912, p. 98, (Mauritius, introduced).

Perdicula argundah. Blanf. and Oates, Avifauna B. I., iv, p. 119 (1898); Jesse, Ibis, 1903, p. 153, (Lucknow); Dewar, Jour. B. N. H. S., xvi, p. 495, (Madras); Ward, ibid, xvii, p. 944, (1907), (not in Kashmir) King, ibid, xxi, p. 100, (1911), (Saugor and Damoh); Whitehead, ibid, xxi, p. 168, (1911), (Sehore).

Vernacular names.—Lowa (Hin. and Mahr.); *Lawanka,* (Tel.); *Sinkadah,* (Tam.); *Kempa-lowya,* (Can. Mysore).

Description, adult male, differs from *P. a. asiatica* in having the mantle, scapulars and innermost secondaries barred with pale buff, rufous buff or pale rufous, these bars edged with black; the pale streak between the rufous throat and the cheeks is wanting; there is not nearly so much black on the upper plumage, the bold-black spots on the mantle are wanting or are much fewer in number; the primary quills are barred on both webs; the black above the pale supercilium is wanting and the pale supercilium itself is less distinct.

Female. Whole upper parts vinous rufous, the rump, upper tail-coverts and tail faintly barred with brown and white; the mantle is occasionally sparsely speckled with tiny white and black spots; below the chin and throat are less rufous than in *P. a. asiatica*, and are practically the same colour as the breast, the point only of the chin being truly rufous. The inner webs of the primaries are barred or mottled with buff and not all brown as in the last bird.

In both sexes the variation in plumage is very great, but seems to bear no relation to age, habitat or season. Males of both the Jungle Bush Quail and the Rock Bush Quail vary in general appearance from pale grey or buffy grey birds to such as appear to be rich black and brown, rich rufous or rufous chestnut.

Some birds are quite intermediate between the two races and might be assigned to either.

Measurements.—The same as for the Jungle Bush Quail. Wings of males vary from 82 to 91 mm. and of female from 79 to 94 mm.

Distribution.—The South Eastern Peninsula of India from South of Madras—it is rare near Madras itself—to the extreme South but it does not occur in Ceylon. It extends to the drier plains of Mysore and Travancore, to parts of the Bombay Presidency, almost throughout the Deccan, Rajputana, Cutch, Guzerat, to the United Provinces and Oudh and to portions of the Punjab.

The habitat of the two Bush Quails constantly overlaps, as I have already pointed out, but so far there is nothing to show that the two ever breed both in the same locality.

Nidification.—Like the Jungle Bush Quail this bird is resident wherever found though it may move about locally under weather pressure. It breeds from August to March, according to Hume, principally in the months of August, September and March, but most records for the Deccan, Mysore and Bombay are from October to December. Davidson also took its eggs in April in Sholapur. The nest is similar to that of the last bird, a fairly compact little cup of grass and roots placed in a depression in the ground either natural or scratched out by the birds. As a rule it is placed in fairly long, but thin, grass, at other times under a bush and, more rarely, under the protection of a rock or boulder or in a crevice between two or more of these. Sometimes practically no nest at all is made, merely a few grass blades or roots being placed in the hollow below the eggs, and this seems to be the case more often with *P. a. argoondah* than with *P. a. asiatica.* The eggs vary from four to seven in number, and are quite indistinguishable from those of the last bird. Sixty eggs average 25·9×20·8 mm., maxima

28·8 × 19·5 and 28·3 × 22·4 mm.; minima 24·3 × 19·5 and 24·4 × 18·9 mm.

Habits.—Hume in a paragraph very much to the point gives us the manner in which the two Bush Quails differ. He says :—

> "It is in the nature of the localities it affects that (as in the case of the Jungle Bush Quail) the key to its irregular distribution is to be found ; it avoids mountains, which it never ascends, forest and thick jungle and eschews well watered and richly wooded or cultivated tracts; it loves dry, open, sandy or even rocky plains or low hillocks, sparsely studded with thin thorny bushes ; elevation is not of so much consequence to it as the openness and semi-waste character of the place. You will find it equally at home on the plains of Ajmere, at an elevation of 1,700 feet, and near sea level in the Carnatic. Dry half-barren, sparsely cultivated plains districts are its choice, and hence it follows that although, where localities such as it affects intergrade with those that the Jungle Bush Quail prefers, you may shoot both species in the same stubble yet broadly speaking where you find the Rock Bush Quail, there, as a rule, you do not find the other."

Like the Jungle Bush Quail this little bird is very gregarious and sociable, collecting in the same small flocks of a dozen to twenty birds, and always maintaining the same close formation. Even during the breeding season, or, at any rate, as soon as the chicks have hatched, they seem to feed in parties consisting of two or more families, for chicks both newly hatched and some days old have been seen feeding in company with several adult birds. Both this and the last bird are equally combative but both seem able to restrain their feelings once they have their young ones to look after and the males are most admirable fathers.

Both these Quail occasionally perch on bushes and low trees, but this is probably only when they are suddenly frightened. Most of our Indian game birds will take refuge in a tree when disturbed by dogs and some will even attempt to hide in the higher foliage under these circumstances but these quail only perch low down just out of reach of ground vermin.

They roost on the ground, under bushes and rocks, every member of the covey tucked as close in to his neighbours as possible.

In voice, flight, diet, etc., there is nothing to add about this bird which has not already been said about the Jungle Bush Quail.

(*To be continued.*)

GAME ANIMALS OF KASHMIR AND ADJACENT HILL PROVINCES.

BY

COL. A. E WARD.

PART VI.

(*Continued from page 35 of this Volume.*)

BEASTS OF PREY.

BEARS.

(*With 4 plates.*)

No. 98 THE BLACK BEAR. *Selenarctos thibetanus,* F. Cuv.

There are still several black bears in the hills. As a rule they do not hibernate but move into the lower ranges where they can get food, and also where there is no snow ; for on frozen snow they cannot travel far.

Some, especially she bears with cubs or about to have a family, lie up in the winter, so also do old males that have taken up their abode in the higher mountains.

Often at night when the snow has driven the bears into a cave or a hollow tree they can be heard ; if the place can be found and the animal moved traces of blood will be found in the frozen snow for the paws of the beast are evidently soft from not being used.

Most people who come to Kashmir have heard of the ' bear shoots ' in Poonch, the bears are mostly Kashmir bears which are migrating in the month of November, they stay in Poonch to eat the acorns and then move downwards.

It has been said that it is a shame to kill so many black bears in the ' Poonch shoots ' but it is not, for they are most destructive not only to the crops but they often kill the villagers and badly maul many. It is not that the bear comes headlong out of the forest to attack people, but often it will stay down in the maize crop during the day and will go for the cultivator when suddenly come upon, or some unfortunate may meet a she-bear and cubs on a forest track, or even for that matter on a village road in the dusk. Wounded bears are always a danger. One such was hit and not retrieved two years ago in a game reserve. It took up its quarters in a neighbouring ravine and continually attacked villagers; it killed two people and mauled many before it was shot by Mr. McDonald (this was No. 8 in B. list). Small bore rifles should not be used unless the shot is so easy that a kill is almost a certainty for, as mentioned in the previous case, wounded bears become a scourge near the villages. Endless narratives could be given. On one occasion seven wounded bears were left after a beat and of these two or three at least turned cross and mauled many people.

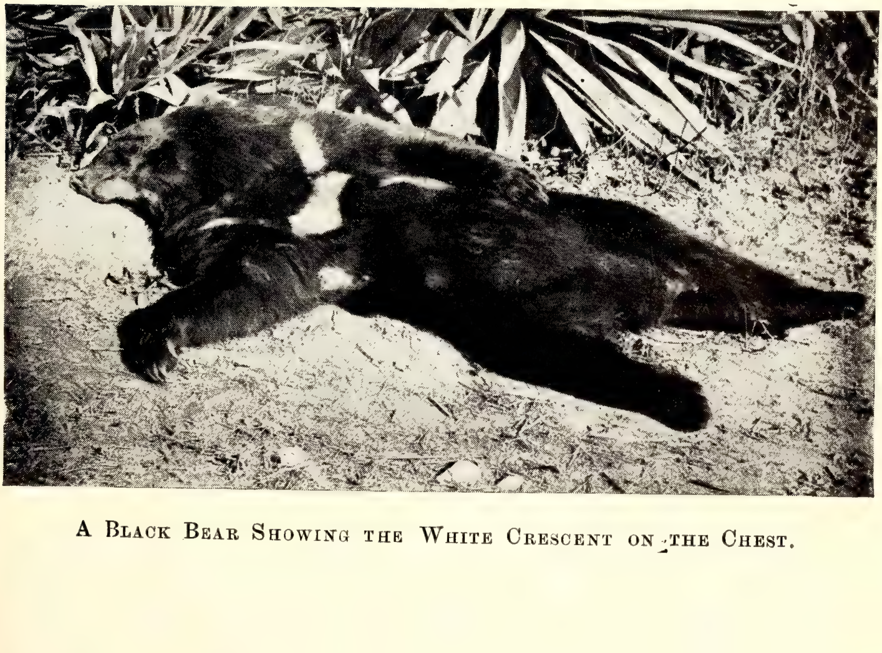
Having thus defended Poonch shoots, here is the result of three days' shooting ; it may be wrong to say sport :—

There were five guns out, including Rajah Baldeo Singh of Poonch. In all there were 4 big drives on different days in jungles separated by many miles. On the 4th day no bears were seen but in the three days fifty-four were brought to bag.

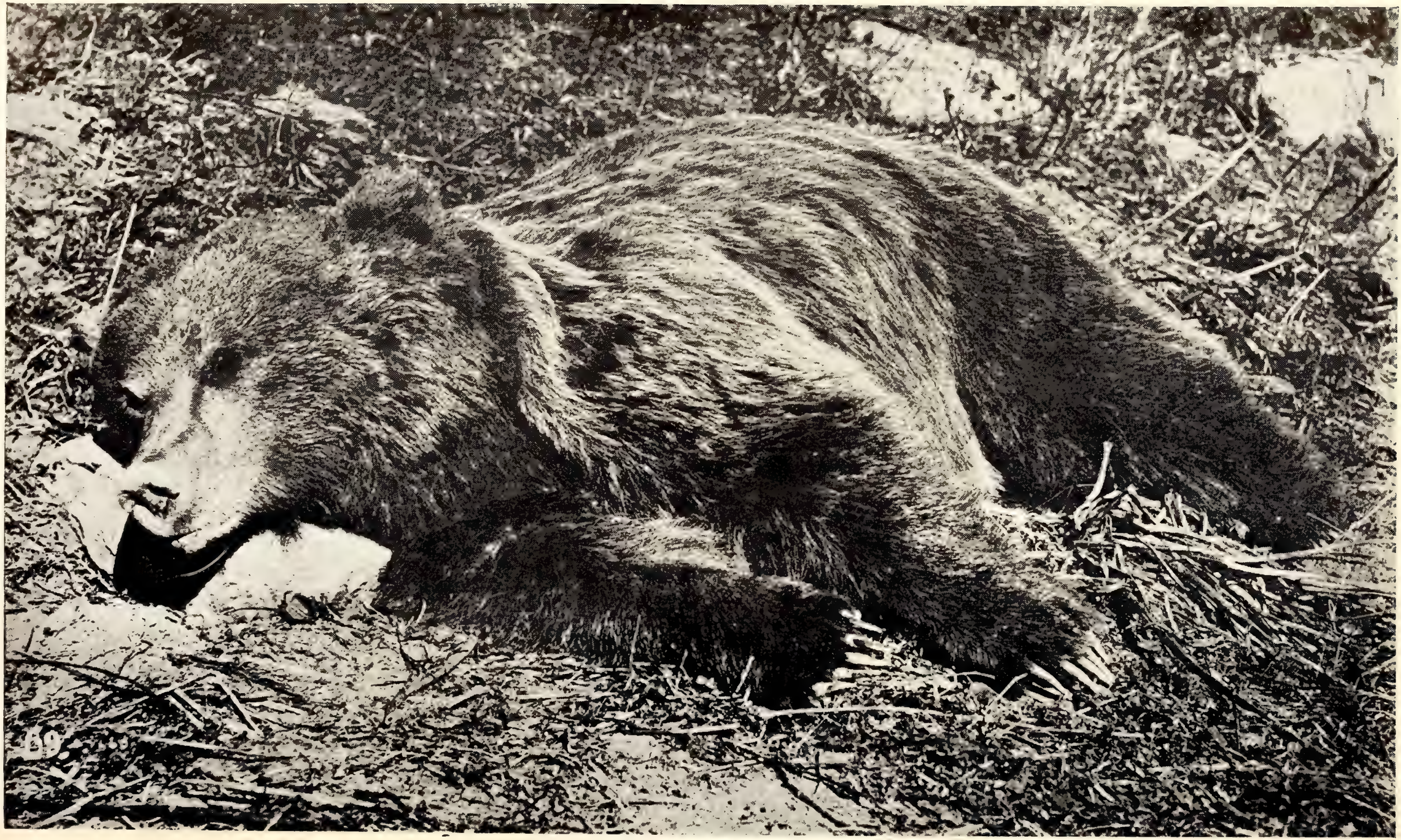
The photo shows the last of the three days shooting results. Photographs of the other two bags were taken and have appeared in print.

There is nothing to be proud of in this. The bears were numerous and they were surrounded and driven by a large pack of trained dogs, but it shows how numerous bears were. Other big bags have been made, it is sufficient to tell of one and of the death of so large a number of these pests. One such shoot is interesting enough, but there remains no desire to participate in a second.

A Bear Shoot in Poonch.



A Black Bear Showing the White Crescent on the Chest.



BROWN BEAR (*Ursus isabellinus*), SHOT AT MHOW, KASHMIR.

MEASUREMENT OF BLACK BEARS.

The custom of following the curves of the body with the tape has led to stories of huge beasts.

A.—*Measurement between pegs of Black Bears.*

Index No.	*Sportsman's name.*	*Length.*	*Sex.*	*Locality.*
1.	W. Mitchell	6′ 9″	Male	Bringl, Lanor,
2.	In a Poonch shoot ..	6′ 4″	,,	
3.	William McPherson ..	6′ 1″	,,	Liddar Valley.
4.	A. E. Ward	6′	,,	,,
5.	A. E. Ward	5′ 11″	,,	Bringl, Lanor.
6.	A. E. Ward	5′ 3″	Female	Chakrata.

These measurements are taken from many scores kindly sent by various sportsmen and by the Game Department.

Mr. W. Mitchell gave the measurement of No. 1 taken by himself, Nos. 2 to 6 were personally taken.

No. 2 was a huge bear—the skin was taken to Naini Tal and seen by many portsmen. Rajah Baldeo Sing, who had seen many hundred dead bears, declared No. 2 to be the biggest he had seen.

B.—*Measured round the curves of the body.*

1.	Norman Leslie	7′ 2″	Male	In 1912.
2.	Capt. H. Graham ..	7′ 1″	,,	In 1918.
3.	A lady	7′ 1″	,,	Kashmir.
4.	R. C. Hanson	6′ 7″	,,	In 1912.
5.	S. McDonald	6′ 5″	Female	Kashmir.
6.	S. McDonald	6′ 3″	Male	,,
7.	S. McDonald	6′ 1″	,,	Dara.
8.	S. McDonald	6′	Female	Sept. 1920.
9.	Col. Turnbull	5′ 11″	,,	Lolab.

Nos. 1 and 2 are owners' measurements. No. 3 was measured by Mr. S. McDonald.

Some bear skins when cured are very large and several of 8′ may be recorded.

There are very big bears in Kulgam reserve of which Rajah Sir Harising has taken toll, notably so in 1920.

As the Poonch shoots give no indication of what can be done in Kashmir by the visitor it is as well to turn to other records.

Colonel Turnbull shot twenty-two black bears in the summer of one year, this was in Lehin Daggan in the Liddar Valley.

It is not often that much excitement is to be got out of a black bear shoot, sometimes howsoever more than enough can be had :—to be accurate the following is taken from a diary of 1898.

Dec. 2nd.—

The party consisted of the Governor of Kashmir, a Tahsildar, self and daughter. Part of a long line of low hills had been beaten on the previous day without any result, the bears and a leopard had gone forward without being fired at, and were probably in the last part of the outlying hill which touched the level ground.

The Governor and Tahsildar did not come out so only one machan could be occupied, this was not a built up concern but consisted of a platform made by putting poles into the hillside and supporting them at their far ends by uprights, moreover it was on a very narrow track which passed along the hill.

The beat advanced on the face of the hill ; whilst the crest was lined with the coolies standing close together.

The machan, such as it was, had been placed about three hundred yards from the end of the jungle, and it was hoped the bears would go thus far before they tried to break back. Shere Singh, the best of Jamadars of shikaries, was in charge and full of zeal.

The first shot was at a young bear which partly showed itself in the jungle, it rolled over to the shot and was pelted with stones by the stops who were in a small machan below, then it broke back and passed through the beaters bleeding at the shoulder.

Next came a three-parts grown bear which fell dead to the shot. Shortly after a big she-bear with cubs came on, a badly placed shot hit her too far back, she was turned by the stops, circled round, and lay down close to the machan, but not within sight.

The beat was now nearly over but drove a big male-bear straight towards the machan and on a level with the platform ; when within a few yards the bullet hit him in the head, rolling him over stone dead. The wounded she-bear came on at the same time and crossed above the platform which, as before stated, simply consisted of horizontal poles. With only one barrel loaded it was a risk but the bear was almost on the platform. She rolled over to the shot, clawed at the machan as she passed, and disappeared. A cub and some other animal which could not be clearly seen came next, the cub was killed and the second beast which was crawling through the bushes was missed. Then the coolies came up, the line was stopped whilst the wounded she-bear was followed up, too sick to show fight she raised her head and was easily brained.

The first bear that was wounded was tracked for a time but was abandoned, for the slain had to be collected and skinned before dark.

From the first shot up to when the wounded she-bear was followed, about ten minutes were taken up, and none of the bears were more than thirty or forty yards from the machan. No accidents happened to any of the beaters which was lucky.

It may be said that the beat had the advantage of official help, but beyond the aid given to collect hundreds of coolies there was nothing gained.

However here is an extract from the diary of a beat conducted by village shikaries and which was more exciting in one way, for bears can get very cross.

The locality was Bringl Lanor and the fighting bear is No. 5 on the list of 'A' measurements.

Bringl Lanor is at the foot of the Panjal range on the Kashmir side, the forest comes close down to the plains and is interspersed with open glades and grassy meadows. The idea of the shikari was to post the guns in a glade on the hill side and to drive the face of the slope, after posting a line of coolies as stops on the crest of the hill which was perhaps a thousand feet above the guns.

G. Allan had the post nearer the flat ground ; he fired very soon after the beat began, and a growling snarl which came immediately after the shot suggested a leopard being hit.

Crouched behind a huge fallen log and facing the beat events were awaited ; above and below was the open glade, the rest was all a forest of firs. The fallen tree was in the middle of the glade and had evidently been brought down by an avalanche of snow.

As monal pheasants were about, the smooth bore was loaded and placed against the log.

Nothing happened for some time, and the coolies had arrived within a few hundred yards when a ten point stag moved slowly through the forest and was shot. The village shikari jumped over the log and rushed forward, taking with him the pouch of cartridges, but as four rifle cartridges were always carried in a little compartment in the shooting coat, the rifle was reloaded leaving one cartridge to spare.

Almost immediately afterwards a big stag crossed the glade above and was duly missed with both barrels and then only one cartridge remained.

The log was lying along and not across the sloping glade, hence a big black bear which came to the edge of the cover could not see the gun until half way across the glade. The bear crossed and had got almost into the forest when the last cartridge was used and by that time the bear and the shooter were on the same side of the log. On being hit it rolled down the slope but pulled up close to the log. After seizing the smooth bore and jumping over the log there was a feeling of relief for perhaps the beast would go away, however it had no such intention, instead it came up to the far side of the log and was looking over when both barrels of No. 4 shot were fired with the result of knocking the bear over and rolling it down the glade where it lodged amongst a mass of broken sticks and stones and howled loudly. It would have been fatal to shout to Allan because the beastly bear might again attack, but on hearing the firing Allan came up and all that remained was to watch him finish off the bear and be thankful. It appeared that Allan's shikari had seen the performance from where he was acting as a stop and had at once gone to fetch his master.

The lesson to be learned is not to fire at a bear when he is immediately above one and certainly not when only one cartridge is available. Where the first shot hit could not be found out but probably in the hind quarters, for a leg was broken; this may have accounted for the beast not getting at once over the log. The charges of shot had knocked one side of the head about and made a hole in the shoulder.

During the time the walnuts are ripe the bears come down close to the villages, it is not a satisfactory kind of sport to shoot at a black patch in a leafy tree, too often it results in a wounded bear going off into the jungle. It is seldom that a clear shot can be got, and then only when the bear is at the top of a tree.

The best way to get bears is to send men out in pairs very early in the morning. If game is seen one man comes in and gives the news, whilst the second watches the movements of the beast.

When the mulberries are ripe many black bears are shot in the trees, for on a cool day they will feed at almost any hour, but the time is passed when on almost any evening a shot could be obtained, now it may take weeks to get a fine bear except in the game reserves; there the bears congregate and are an absolute nuisance, for they destroy the young fruit trees and damage badly the big walnuts. To enable a walnut tree to grow the fruit has to be taken off before ripening or every bough will be broken.

Another reprehensible habit is stripping the bark off the young pine trees, hundreds of blue pine are thus destroyed. Evidently in the spring time the green bark with resin is a favourite food and the damage done to a group of pines about eight to ten feet in height is sad to see.

It may be amusing to watch but it is bad for the tree when the bear makes up his mind to feed leisurely; stretching out his fore legs he gathers the boughs, and makes a small platform on which to stand or sit, then he eats all the mulberries or other fruit within reach. Many of the trees in Dachgam Game reserve are covered with these seats or " bhaitaks " as the shikaries term them. Often and often on a summer evening the bears can be watched, for in some years the valley is full of them but it is now-a-days only in the protected areas that there is much chance of watching and learning the habits of any game.

When the hazels are ripe, bears may be found whilst feeding on the fallen nuts. The hazel abounds at an elevation of 7,000′ to 8,000′. The drawback to shooting then is that the stags are at this time calling, consequently, there is a certain amount of reluctance in disturbing the hill side and many bears are for this reason allowed to go in peace.

The photograph shows one of the favourite resorts of black bears. Near the river two bears were found ; one was close to the foot of a low precipice and the other further away, and both were busy gleaning fallen nuts and were unalarmed. A steady shot was taken at the more distant beast which fell, and the second was hit but carried on towards the river to which it was followed. Up to the water's edge the track was quite plain but what became of it was not discovered. There were no marks on the far side of the river, and where the bear entered the river the water was fairly smooth but down lower the river narrowed and became a torrent. Probably the bear swam downwards and was drawn over the rocks by the current. This bear was hit in the back from above with a ·500 express bullet. In the autumn bears are very fat, the fat breaks up the hollow fronted bullet and prevents it from penetrating. A ·400 soft nosed bullet from a high velocity rifle is a much more efficient projectile to employ against fat bears.

In the accompanying photo the leg of the black bear has been drawn aside in order to show the large white crescent on the breast and the white mark under the shoulders. The centre of this white patch is a deadly spot for a shot to strike if the bear is standing on its hind legs, or when feeding whilst sitting up in a tree.

Whilst listening to a calling stag in the forest, a bear came out of some bushes and walked towards the listener ; it came on slowly and without fear; then some movement attracted it, for it rose on its hind legs and moved about, then advanced on all four legs and again stood up ; when about 20 or 25 paces off there was no alternative but to shoot, the white crescent was a grand bull's eye and the beast fell without a groan.

A short distance off was a bees' nest in a tree, and on the trunk were the marks of the claws ; evidently Bruin was about to feed on the honey when he had been disturbed and moved off to hide. When the coast was clear he had come out and possibly did not see anyone until he rose on his hind quarters for the second time. The stag stopped calling and did not return to that part of the forest.

Stag and bear shooting do not suit one another, many a bear owes its safety to this for they are met with in the day time during the calling season of the Barasingh.

No. 97 The Brown Bear. *Ursus isabellinus*, Horsfield.

The "*Lal Balu*" or "*Harpat*" of Kashmir, The "*Drinmar*" of Baltistan.

"Brown" or as sometimes called "Red Bears" are now very scarce in the Kashmir Hills.

This bear is curiously devoid of the power of sight and hearing, but possesses the sense of smell in an extraordinary degree.

Whether strict preservation in the game reserves and sanctuaries will save the Brown Bear from extinction remains to be seen.

Sportsmen continually ask "where can I get a Brown Bear ?" there is no intention of replying in this article, because the few that remain are better left in peace.

In the distant hills the number is steadily being lessened, this is a pity for on the whole the brown bear is a harmless beast except when it takes to killing ponies and sheep.

The measurements sent in by sportsmen are very confusing—"After skinning," "When pegged out," etc., give no clue to the size of the beast.

There is one entry in the game preservation office,—"Pegged out before skinning, 7′ 6″, shot by Lionel Taylor, and also 7′ 5″ by the same sportsmen." Mr. T. McDonald measured his animals from the end of the nose along the

HAUNTS OF THE BLACK BEAR UP THE LIDDAR VALLEY.

Haunts of the Brown Bear and Ibex.

head to between the ears and then straight to the tail, he gives two measurements 8′ 3″ and 7′ 1″.

A 7′ 0″ bear measured between pegs and shot in Gugai can be personally vouched for.

Admitting that the Brown Bear does grow to a large size, there is no doubt that if measured between pegs, any over 7′ are very rarely shot.

Long ago brown bears were found all over the higher hills from about 7,000′ and upwards.

A story was told to the effect that fourteen were killed in one day between Garan and Nowboog, this seemed to be incredible but worth enquiring about, so, when near that place, old Ramzan Ali, the then famous shikari, was sent for and questioned. He said he and his son were out with a Sahib when a cloud of locusts appeared, they fell in huge numbers on the snow and the bears came out to eat them. He and his sahib shot nine not fourteen.

The Wardwan nullahs used to be full of brown bears, complaints were loudly made that they killed the lambs when the flocks pastured and actually took 22 in one night.

The sheep folds were inspected, in the neighbourhood of these was a great deal of fairly fresh remains of the slain, but nowhere could the print of the bears' feet be found. Taking advantage of a bright moon, a night was spent not far from the sheep ; then the marauders came,—the sheep dogs were the culprits.

In Mir Mullick ravine, however, two brown bears did kill a large number of sheep, one of these bears was killed and the other wounded within a few yards of the sheep folds. It is a nasty business to sit amongst the sheep for they are very smelly.

Can the Himalayan Brown Bear climb a tree ? In other words does he ever do so ?

As a rule there are very few trees on the ground where bears live in summer but in the spring they are often in the forest. In the autumn when the crops are ripe they come into the Indian corn (formerly many could be shot by sitting near the maize fields) in the vicinity of which there are of course fruit trees, but whilst it was a common enough to see the bears under the trees, never once were they observed climbing.

The plate shows a brown bear shot and photographed by Major Ludlow, who has kindly lent it to the Society.

(*To be continued.*)

INDIAN DRAGONFLIES.

BY

MAJOR F. C. FRASER, I.M.S., F.E.S.

PART XVI.

(With 3 Text-figures.)

(*Continued from page 47 of this Volume.*)

Sub-Family—GOMPHINÆ.

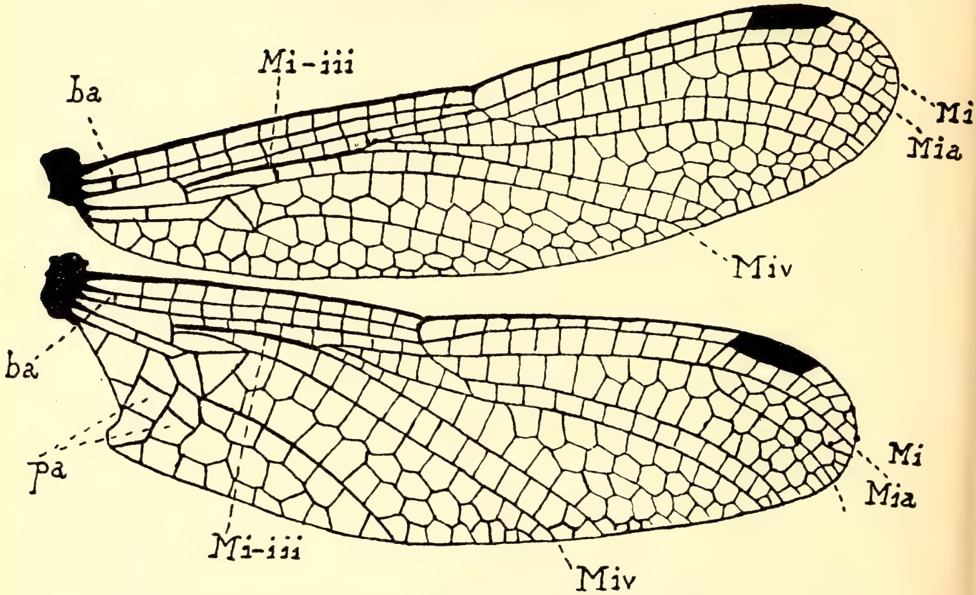


Fig. 1.—Semi-diagrammatic figure of wings of a typical *Gomphus.*

The portion of Mi-iii, employed in the key, is here shown heavily delineated. (In the forewing 3 transverse nervures are shown between Mi-iii and Miv, in the hindwing only 1.) In the forewing only 1 row of cells is shown between Mi and Mia, in the hindwing 2 rows of cells. (In some species such as *Heterogomphus* 3 rows are present.)

pa. Postanal cells. 3 rows are here shown but there may be as many as 5 rows. In the forewing 1 or 2 rows are generally present.

ba. Basal antenodel nervure of the second series. (This is not present in the majority of the genera.)

The trigones are shown complete but in some genera they are split up by one or more traversing nervures.

The stigma is shown moderately small as is usual in most genera but in some it is considerably longer than one-fourth of the distance between the node and the distal end of stigma.

The present subfamily, which is richly represented in the Indian Odonate fauna, consists of a large group of strikingly homogeneous insects.

Their origin has been traced back to earliest Mesozoic times, the remains of an undoubted Gomphine having been found in the Lias.

All bear a simple colour pattern of black and yellow, the two parts of which show an infinite variation, the yellow in some occupying the greater part of the field or the black obliterating largely the yellow. The two colours also show great variation, from black to light brown and from a creamy yellow through citron yellow to reddish yellow or dirty ochreous shades.

The neuration of the wings is almost as uniform as the colour scheme but Mr. E. B. Williamson, after a careful study of the Indo-Malayan forms, has been able to pick out a number of moderately constant differences which are invaluable for systematic purposes. A systematic arrangement based entirely on the neuration is however difficult and there seems to be no reason why the efforts of early monographers who systematized from the shape of the male anal appendages should not be combined with such a system. It at least facilitates the formation of a workable key for the identification of the species.

It is true that the employment of unisexual characters is open to the serious objection that a number of species are known from the females only but I find that even the neurational characters mentioned by Mr. Williamson are not infrequently seen to differ in the two sexes, so that here again we are up against the same difficulty.

A study of the genitalia which has never been carried out, and which I have attempted on a small scale below, may eventually throw more light on the true relationships of the genera. In no subfamily do we find so many bizarre forms and wide variations of the anal appendages as we do in the *Gomphinæ*. To the uniformity of the neuration and colour scheme, this variation of the appendages affords a striking contrast.

Uniformity is again found when we come to investigate the habits of the species which differ markedly from those of other Anisopterids.

Their seasonal appearance is extremely short; most species appear in swarms and then either migrate for long distances or scatter throughout the adjacent country.

Their protective colouring is adapted for concealment. When hovering over the rippling surface of a stream they are almost invisible amongst the glittering and flickering shafts of light which emanate from its surface. In such cases I have had to adopt the expedient of lowering my head almost to a level with the surface of the water before I could obtain a clearer view of the insect outlined in profile against the background of the opposite side of the stream.

Anormogomphus possesses two species whose pale and almost unmarked colouring harmonizes well with the sandy areas within which they are found.

Heliogomphus, *Burmagomphus* and *Indogomphus* adopt a close colour pattern of black and yellow which is almost invisible amongst the green foliage on which they invariably rest.

Macrogomphus shows a great partiality for babul trees where its black and yellow is hidden amongst the rich yellow of the wattle-like blooms which adorn those trees.

Other species such as *Ictinus*, *Gomphidia* and *Gomphus* scorn any disguise and come boldly out into the open, the former perching on reed heads or prominent branches and twigs overhanging their watery retreats, whilst the latter are usully found settled on rocks in mid-stream. Such species rely entirely on the swift flight with which Nature has endowed them, *Ictinus* especially being probably the swiftest of all dragonflies. I have seen the females of this genus (which always roost high up in trees) descend to the water and after lashing its surface two or three times in the act of ovipositing, return to their resting place with the swiftness of lightening. The whole act of descent, ovipositing and ascent occupied but a few seconds. I have never once been able to capture a female *Ictinus* in flight, such specimens as I possess having been secured when paired with the males. Like most other dragonflies, females are rarely seen near water except when ovipositing.

The larvæ are highly specialized. The tarsi of the fore and middle legs are only two-jointed thus differing from larvæ of other families. Some larvæ are stout and rotund like spiders, the abodmen flattened beneath and strongly keeled above, (*Ictinus* and *Gomphidia*), others are long and cylindrical whilst a third type are extremely broad and flattened. Most species have short robust legs adapted for digging, a circumstance arising from their habit of burrowing in mud in search of prey. Others lie on the muddy bottoms of streams concealed by a thin film of mud or lie up amongst leafy debris.

The antennæ are short and clubbed, consisting of 3 or 4 joints, but in *Lamellogomphus* the penultimate joint is expanded into a triangular lamella.

Oviposition varies, the female of *Ictinus* whipping the surface of streams in a similar way to the *Libellulinæ* ; *Gomphus nilgiricus* stabs its eggs into wet sand with its long ovipositor, whilst *Lamellogomphus biforceps nilgiriensis* hovers motionless over the surface of water and drops its eggs at intervals. The tiny yellow eggs can be seen falling distinctly at regular intervals and the insect is so confidential that often a net can be cautiously inserted beneath it and the eggs actually caught.

The imagines of many species emerge in swarms but what actuates the simultaneous emergence it is difficult to say. Usually it occurs after very heavy rain and it may be that the volume of silt swept into streams considerably raises the temperature of the water, this acting either as a signal or a stimulus for the larvæ to emerge. I have seen *Anormogomphus kiritschenkoi* arising in vast swarms from the fresh water holes beyond Zobeir, Mesopotamia. Ten or more could be taken with a single sweep of the net and for some three weeks I was feeding a large family of lizards exclusively on this diet. At Poona in 1916 and 1918 I saw large swarms of *Burmagomphus pyramidalis* and *Microgomphus torquatus* emerging from the Moolah canal and smaller swarms of *Cyclogomphus hypsilon* from the Katraj Lake.

The emergence in every case took place after heavy thunderstorms, the particular one at Zobeir nearly washing us out of camp.

As regards migration I have seen large numbers of *Lindenia tetraphylla* come on board a Hospital Ship in the Persian Gulf some 40 miles or so below the bar of the Shat-el-Arab. I have also seen *Macrogomphus* travelling inward from the Poona river in considerable numbers and for days afterwards it was hardly possible to scan a babul tree which had not at least two or more occupants.

Ictinus rapax and *Lamellogomphus biforceps* are the only two species which I have observed attacking one another and this merely to drive off others from their own particular beat. Pairing takes place over water and the couples then fly inland for a short distance and come to rest on low herbage. The female is unaccompanied when ovipositing, this act usually taking place late in the afternoon or in cloudy weather when the males have gone to rest.

They breed alike in running and still waters but the former is usually preferred. I have found breeding in streams *Gomphus, Heliogomphus, Indogomphus, Lamellogomphus, Onychogomphus, Anisogomphus* and *Ictinus* whilst *Cyclogomphus, Anormogomphus* and *Gomphidia* prefer still waters.

Their aquatic life is probably a long one, *Gomphus nilgiricus* which was seen on the wing in 1921 was entirely absent in the following year. *Lamellogomphus biforceps* was scarce in 1921 but quite common in 1922, so that one may infer that these two species pass two years in their watery home.

March to May and September to October are the months when most species are on the wing, the latter period more especially. At Poona in September, *Macrogomphus, Microgomphus, Onychogomphus, Cyclogomphus, Burmagomphus, Ictinus* and *Gomphidia* were all on the wing at one time. *Onychogomphus lineatus*, a dominant species, is found nearly all the year round but this is exceptional. It is neither seasonal nor does it appear in swarms.

I have arranged the genera according to Williamson's grouping as revised and amplified by Laidlaw. I have however removed the latter's Section IV to a distinct genus "*Lamellogomphus*" on account of the specialization of the larvæ.

The following key embraces the *Cordulegasterinæ* as well as the whole of the Indian *Gomphinæ*. I have included the former as they are fairly closely related to the latter and also because I omitted to furnish a key when discussing that subfamily.

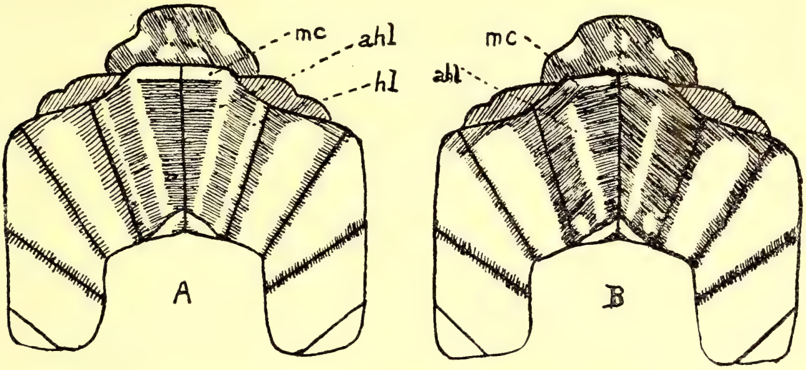


Fig. 2.—Diagrammatic figure of thorax of a typical *Gomphus*. The dorsal and left lateral aspects are shown.

mc. Mesothoracic collar. (Shown complete in *A*, incomplete in *B*.)

ahl. Antehumeral stripes. (Shown united to mesothoracic collar in *A*, separated in *B*.) *hl*. Humeral stripe. (Shown fully developed in *A*, rudimentary in *B*, represented merely by a small upper spot, but even this may be absent.) In some species only the upper part of the antehumeral stripe and the lower part of the humeral is present, the two being united obliquely at their middles. (A bayonet-like stripe thus takes the place of the two stripes.)

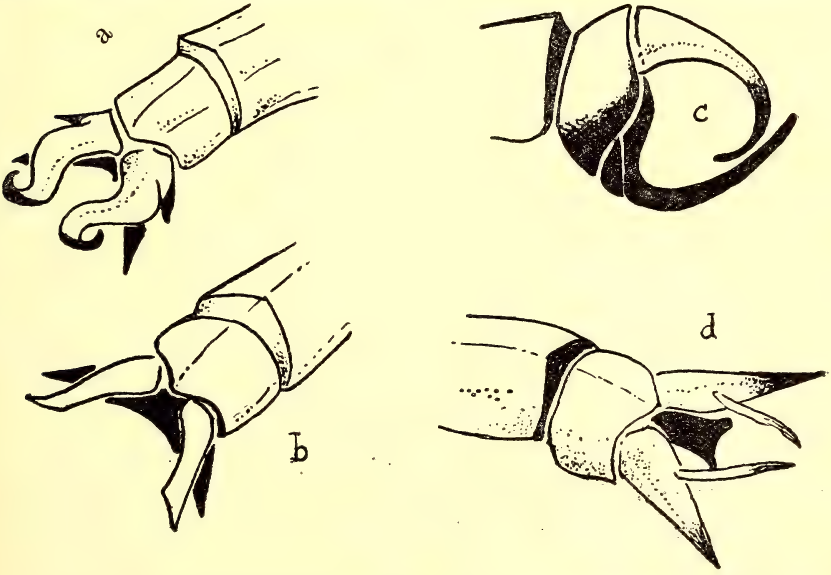


Fig. 3.—Anal appendages of *Gomphines*. *a*. Lyrate appendages. *b*. Typical *Gomphus* appendages. *c*. Typical *Lamellogomphus* appendages. *d*. Branched appendages of *Cyclogomphus*.

Key to Subfamilies—CORDULEGASTERINÆ AND GOMPHINÆ.

1. Mid-lobe of labrum with a deep median fissure 2
Mid-lobe of labrum entire 9

2. Subfamily *Cordulegasterinæ* :—
Median (or prearcular) space without cross veins 3
Subfamily *Chlorogomphinæ* :—
Median space traversed 7

3. Genus *Cordulegaster* :—
Head transversely elongate ; frons not as high as occiput ; stigma short 4
Genus *Anotogaster* :—
Head globose ; frons as high as occiput ; stigma long .. 6
Genus *Allogaster* :—
Frons greatly developed, very high and almost as wide as eyes ; stigma long .. .. .. *Allogaster latifrons.*

4. Face pale brown, unmarked .. .. *Cordulegaster parvistigma.*
Face bright yellow, marked with black 5

5. Abdominal segments 4 to 9 with subbasal yellow lunules and small apical linear spots .. .. .. *Cordulegaster brevistigma.*
Abdominal segments 4 to 9 with smaller yellow lunules and without apical spots .. .. .. *Cordulegaster bidentatus.*

6. Venation yellow ; 10th abdominal segment marked with yellow .. .. *Anotogaster basalis.*
Venation black ; 10th abdominal segment unmarked. *Anotogaster nipalensis.*

7. Genus *Orogomphus* :—
Hindwing very much broader than forewing in the female. *Orogomphus xanthoptera.*
Fore-and Hind-wings not markedly differing in breadth .. 8

8. Thorax with 3 lateral yellow stripes .. *Orogomphus speciosus.*
Thorax with only 2 lateral stripes. .. *Orogomphus atkinsoni.*

9. Subtriangle of forewing and hypertrigones traversed .. 10
Subtriangle of forewing and all hypertrigones entire .. 17

10. Genus *Ictinus* :—
Lateral margins of 8th abdominal segment with lateral foliate dilatations 11
Genus *Gomphidia* :—
Lateral margins of 8th abdominal segment not foliately dilated. 16

11. Face largely black ; hinder border of thorax black ; femora largely black or brown 12
Face largely yellow ; hinder border of thorax yellow ; femora largely yellow 15

12. Epistome without a yellow spot ; 8th abdominal segment without a yellow ring .. .. *Ictinus pertinax.*
Epistome with a median yellow spot and 8th abdominal segment with a yellow ring 13

13. Lateral black stripes on thorax joined at their middles so that the yellow is reduced between them to an upper and lower spot .. .. .. *Ictinus rapax mordax.*
Lateral black stripes on thorax separated 14

14. Black at base of upper surface of frons connected with the black on front of frons ; yellow annule on abdominal segment 3 occupying only the basal third. *Ictinus rapax præcox.*
Black at base of upper surface of frons not connected with the black on front of frons ; yellow annule on abdominal segment 3 occupying the basal half .. .. *Ictinus rapax rapax*

15. Labrum not bordered with black; back of head black; lateral expansion of 8th abdominal segment marked with yellow. *Ictinus atrox.*
Labrum bordered with black; back of head black and yellow; lateral expansion of 8th abdominal segment unmarked .. *Ictinus angulosus.*

16. Face yellow .. .. *Gomphidia T-nigrum*
Face largely black .. .. *Gomphidia abbotti.*

17. Superior anal appendages branched 18
Superior anal appendages unbranched 21

18. Genus *Microgomphus*:—
Small species with abdomen not longer than 25 mm.; 9th abdominal segment shorter than the 8th 19
Genus *Macrogomphus*:—
Large species with abdomen about 50 mm. in length; 9th abdominal segment greatly elongated, longer than the 8th .. 20

19. A single medial stripe on sides of thorax; dorsal thoracic stripes not connected with the mesothoracic collar .. *Microgomphus torquatus.*
A single medial stripe on sides of thorax forming a "Y" with another short stripe which meets it obliquely at its middle; dorsal thoracic stripes, connected with mesothoracic collar. *Microgomphus lilliputians.*
Two fine lateral stripes outlining the lateral sutures of thorax. *Microgomphus loogali.*

20. Sides of thorax yellow, the sutures finely outlined in black; juxta-humeral stripe present in its upper part... *Macrogomphus montanus.*
A broad black stripe on sides of thorax; juxta-humeral stripe absent; 9th abdominal segment unmarked .. *Macrogomphus robustus.*
A broad black stripe on sides of thorax; juxta-humeral stripe represented by a small upper spot; 9th abdominal segment with a small yellow lateral spot .. *Macrogomphus annulatus.*

21. Trigone of hindwing and occasionally that of forewing also traversed by a nervure 22
All trigones entire 24

22. Genus *Perissogomphus*:—
No basal antenodal nervure of 2nd series present; 2 rows of cells in anal area of forewing; 2 rows of discoidal cells to beyond level of node .. .. *Perissogomphus stevensi.*
Genus *Davidius*:—
Basal antenodal nervure of 2nd series usually present; only a single row of cells in anal area of forewing; 3 rows of discoidal cells at level of node 23

23. Mesothoracic collar coalescent with a short band on the lower part of middorsal carina, rest of dorsum of thorax black .. .. *Davidius davidi assamensis.*
Mesothoracic collar and antehumeral stripes coalescent forming a broad middorsal band; a fine humeral line also present. *Davidius aberrans.*
Middorsal carinal band connected with mesothoracic collar; antehumeral band represented by a small upper cuneiform spot only .. .. *Davidius davidi davidi*
Antehumeral bands separated from each other but connected to a broken mesothoracic collar; humeral band represented

23. by a small upper spot and a lower fine stripe .. *Davidius stevensi.*
Mesothoracic collar connected to a band on the middorsal carina; antehumeral stripes present slightly dilated above; humeral stripe represented by an upper spot and fine lower stripe .. .. *Davidius zallorensis.*

24. Genus *Anormogomphus*:—
Base of hindwing rounded in both sexes. .. *Anormogomphus heteropterus.*
Base of hindwing in male strongly angulated and notched .. 25

25. Superior and inferior anal appendages both divaricate and of about equal length 26
Only the inferior appendages divaricate or neither 37

26. Genus *Platygomphus*:—
Abdominal segments 7, 8 and 9 widely dilated; base of hindwing in male only slightly excavate 27
Abdominal segments 7, 8 and 9 only slightly or not at all dilated; base of hindwing in male deeply excavate 28

27. Abdominal segments 3-8 with confluent dorsal spots and basal rings .. .. *Platygomphus dolobratus.*
Abdominal segments 5-7 with basal rings only *Platygomphus feæ.*
Abdominal segments 3-6 with a narrow basal ring connected to a fine dorsal line; segment 7 with a broad basal ring tapering to the apex.. .. .. .. *Platygomphus martini.*

28. Genus *Gomphus.*
Large species with abdomen over 40 mm. in length; superior and inferior anal appendages equally divaricate 29
Genus *Burmagomphus*:—
Smaller species with abdomen less than 40 mm. in length; inferior anal appendages distinctly more divaricate than the superior 35
Genus *Ophiogomphus.*
Palæarctic species from Kashmir with characters resembling *Gomphus* but with an ill-defined loop in the anal area of hind wing .. .. *Ophiogomphus reductus.*

29. Dorsal thoracic stripes connected with the mesothoracic collar 30
Dorsal thoracic stripes not connected with mesothoracic collar 34

30. Anal appendages bright yellow . *Gomphus cyanofrons.*
Anal appendages black 31

31. Vestigial antehumeral stripe present as a spot or short stripe 32
Antehumeral stripe entirely absent *Gomphus nilgiricus.*

32. Lateral sutures of thorax heavily outlined in black, these sometimes almost coalescent 33
Lateral sutures of thorax finely outlined in black, that of anterior suture broadly interrupted in its middle. *Gomphus personatus.*

33. Mesothoracic collar broadly interrupted. *Gomphus xanthenatus.*
Mesothoracic collar only finely or not interrupted .. *Gomphus o'doneli.*

34. Stigma black, unbraced; mesothoracic collar only slightly interrupted .. .. *Gomphus promelas.*
Stigma yellow, unbraced; mesothoracic collar widely interrupted. *Gomphus ceylonicus.*
Stigma black, braced; mesothoracic collar not interrupted. *Gomphus laidlawi.*

35. Humeral lines represented by a small upper spot of yellow; antehumeral lines straight, connected with the mesothoracic collar .. .. .. *Burmagomphus duarensis.*

35. Humeral lines absent; antehumeral lines sinuous, not connected with the mesothoracic collar 36
Humeral line well defined; antehumeral lines straight, not connected with the mesothoracic collar . *Burmagomphus sivalikensis.*

36. Mesothoracic collar slightly interrupted in the middle line; dorsal stripes on abdominal segment 3-5. *Burmagomphus vermiculatus.*
Mesothoracic collar broadly contiguous; no dorsal stripes on abdominal segments 3-5 .. *Burmagomphus pyramidalis.*

37. Genus *Heterogomphus*:—
3 rows of cells between *Mi* and *Mia* at level of outer end of stigma; anal appendages directed straight back, the inferior with a small spine on the inner side of its apex 38
Not more than 2 rows of cells between *Mi* and *Mia*; anal appendages variable 41

38. Antehumeral stripes meeting the mesothoracic collar .. 39
Antehumeral stripes not meeting the mesothoracic collar.... .. 40

39. Hindwing 50 mm. in length; abdomen 58 mm. *Heterogomphus smithi.*
Hindwing 40 mm. in length; abdomen 47 mm. *Heterogomphus bicornutus.*

40. Medial black stripe on sides of thorax spotted with yellow.. *Heterogomphus risi.*
Medial black stripes on side of thorax unmarked. *Heterogomphus ceylonicus.*

41. More than 2 transverse nervures between *Mi-iii* and *Miv* in the hindwing 42
Only 1 transverse nervure between *Mi-iii* and *Miv* in hindwing 47

42. Genus *Heliogomphus*:—
Superior anal appendages lyre-shaped as seen together, tapering and curling like the horn of a cow seen individually; basal antenodal nervure of 2nd series absent 43
Genus *Leptogomphus*:—
Superior anal appendages subtriangular with a basal and outwardly inclined tooth; basal antenodal nervure of 2nd series present 45

43. Two straight parallel dorsal thoracic stripes not connected with the mesothoracic collar; 7th abdominal segment with basal marking 44
Two oval dorsal thoracic spots converging above; 7th abdominal segment unmarked .. *Heliogomphus spirillus.*

44. Occiput bearing a yellow spot; 7th abdominal segment with basal triangular spots .. .. .. *Heliogomphus nietneri.*
Occiput black, thorax heavily pruinosed beneath; 7th abdominal segment with broad basal ring *Heilogomphus pruinans.*

45. Dorsal stripes connected with mesothoracic collar; antehumeral stripe interrupted .. .. ..*Leptogomphus maculivertex.*
Dorsal stripes not connected with mesothoracic collar; antehumeral stripe complete 46

46. Abdominal segments 3-5 bearing a fine dorsal stripe or entirely black.. .. .. *Leptogomphus gestroi.*
Abdominal segments 3-5 bearing lateral spots or rings .. *Leptogomphus inclitus.*

47. Inferior anal appendages divaricate, cleft to the base .. 48
Inferior anal appendages not divaricate, variable 54

48. Genus *Anisogomphus*:—
Superior anal appendages yellow, very small, parallel, closely

apposed, with a downwardly directed black basal process; no basal antenodal nervure of 2nd series 49
Genus *Temnogomphus*:—
Superior anal appendages small, yellow, parallel but not closely apposed and without basal process; basal antenodal nervure of 2nd series present .. .. .. *Temnogomphus bivittatus.*
48. Genus *Indogomphus*:—
Superior anal appendages lyrate like those of *Heliogomphus*; abdominal segment 9 as long as segment 8. *Indogomphus longistigma.*
Genus *Cyclogomphus*:—
Superior anal appendages small, closely apposed, no basal process present; basal antenodal nervure of 2nd series present: very small species with abdomen not longer than 28 mm. dilated fusiformly at the end 50

49. Black bands on sides of thorax very thick; dorsal bands not confluent with upper end of antehumeral stripe .. .. *Anisogomphus occipitalis.*
Black bands on sides of thorax very fine; dorsal bands confluent with upper end of antehumeral stripe .. *Anisogomphus orites.*

50. Face largely black; a yellow spot on vertex. *Cyclogomphus verticalis.*
Face largely yellow; no spot on vertex 51

51. Very small species with abdomen 22 mm. in length, hindwing 21 mm. .. .. *Cyclogomphus minusculus.*
Larger species with abdomen 25 mm. or more in length, hindwing 25 mm. or more 52

52. A black "Y" shaped mark on sides of thorax. *Cyclogomphus heterostylus.*
No black " Y " shaped mark on sides of thorax 53

53. Hindwing 25 mm. long .. .. .. *Cyclogomphus vesiculosus.*
Hindwing 29 mm. long .. .. .. *Cyclogomphus ypsilon.*

54. Genus *Stylogomphus* :—
Superior anal appendage long, sinuous, tapering, black; inferior appendage black, cleft slightly at apex... *Stylogomphus inglisi.*
Genus *Lamellogomphus* :—
Inferior anal appendage as long as or longer than the superior, both separated at the base, converging at the apices, long and forcipated 55
Genus *Onychogomphus* :—
Inferior anal appendage shorter than, often much more so than the superiors, both closely apposed 58

55. Humeral stripe absent 56
Humeral stripe present .. *Lamellogomphus biforceps biforceps.*

56. Dorsal bands isolated, not connected with mesothoracic collar. 57
Dorsal bands connected with mesothoracic collar .. *Lamellogomphus biforceps nilgiriensis.*

57. Legs entirely black; labrum marked with yellow spots. *Lamellogomphus biforceps acinaces.*
Legs marked with yellow; labrum unmarked .. *Lamellogomphus biforceps sp. Laid.*

58. Dorsal thoracic stripes not connected to mesothoracic collar. 59
Dorsal thoracic stripes connected to mesothoracic collar .. 64

59. Dorsal thoracic stripes, short and oval 60
Dorsal thoracic stripes, elongate, not oval 62

60. Anal appendages black .. .. .. *Onychogomphus lindgreni.*
Anal appendages yellow 61

61. 9th abdominal segment entirely black .. *Onychogomphus frontalis*
9th abdominal segment marked with yellow. *Onychogomphus lineatus.*

62. Abdominal segments 3-6 black marked with narrow basal yellow rings. Abdomen and hindwing, less than 30 mm. *Onychogomphus modestus.*
Abdominal segments 3-6 black marked with very broad basal yellow rings. Abdomen and hindwing more than 30 mm. in length 63

63. Occiput bearing 2 small black spines .. *Onychogomphus cerastes.*
Occiput bearing 10 to 12 small spines. *Onychogomphus echinoccipitalis.*

64. Many of the cross nervures at base of wing pale yellow .. *Onychogomphus sp.* Laid.
None of the basal cross nervures yellow 65

65. 6th abdominal segment with less than the basal half yellow.. 66
6th abdominal segment with the basal half or more yellow .. 70

66. Lateral black stripes on thorax entirely confluent 67
Lateral black stripes on sides of thorax only partially confluent. 68

67. Abdominal segments 3-7 with the basal fifth yellow .. *Onychogomphus maclachlani.*
Abdominal segments 3-6 with the basal fourth yellow, segment 7 with the basal half yellow .. *Onychogomphus saundersii.*

68. Face largely black, epistome black marked with yellow .. 69
Face largely yellow, epistome yellow marked with black .. *Onychogomphus circularis.*

69. Abdominal segments 8-10 all black .. *Onychogomphus annularis.*
Abdominal segments 8-10 black marked laterally with yellow. *Onychogomphus M-flavum.*

70. Occiput black; antehumeral line complete. *Onychogcmphus bistrigatus.*
Occiput with a yellow spot; antehumeral line vestigial .. *Onychogomphus aureus.*

(*To be continued.*)

A DESCRIPTION OF THE NESTS AND EGGS OF THE COMMON BIRDS OCCURRING IN THE PLAINS OF THE UNITED PROVINCES.

By

E. H. N. Gill

Part III.

(*With 2 plates.*)

(*Continued from page* 116 *of this volume.*)

Lanius lahtora (469)	The Indian Grey Shrike.
Local name	Safed latora.
Anglo-Indian name	The Large Butcher-Bird.

This species is pretty commonly distributed throughout the Province, but being essentially a bird of open undulating plains and scrub jungle, it is seldom or never met with in the vicinity of human dwellings. It flourishes in dry country and grass lands where that hardy acacia, the babool, holds sway; and where its harsh croak and conspicuous black and white colouring never fails to attract attention.

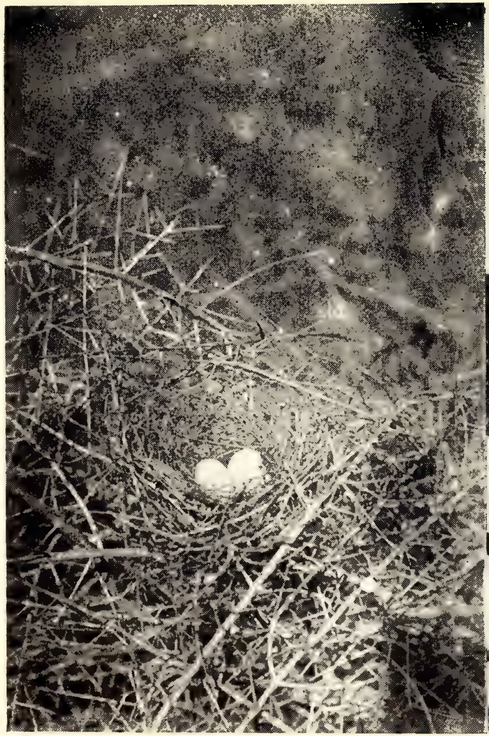
Under ordinary conditions the Indian Grey Shrike would appear to be almost wholly insectivorous, living at peace with all his smaller and weaker feathered neighbours. But as the period of nidification approaches he becomes most aggressive and carnivorous to a degree; a malignant wolf in lamb's clothing, and a veritable plague to all other feathered society. Plundering eggs, and killing the young of birds smaller than himself, and harassing larger species till they quit the vicinity altogether.

Death by slow torture, as practiced by this species, is reminiscent rather of the Spanish Inquisition, save that the tragedies are enacted in the interests of a more laudable purpose. The young Shrikes are born with the most insatiable appetites, and in order to cater for this contingency the adult birds resort to a practice as ingenious as it is cruel, as effective as it is horrible.

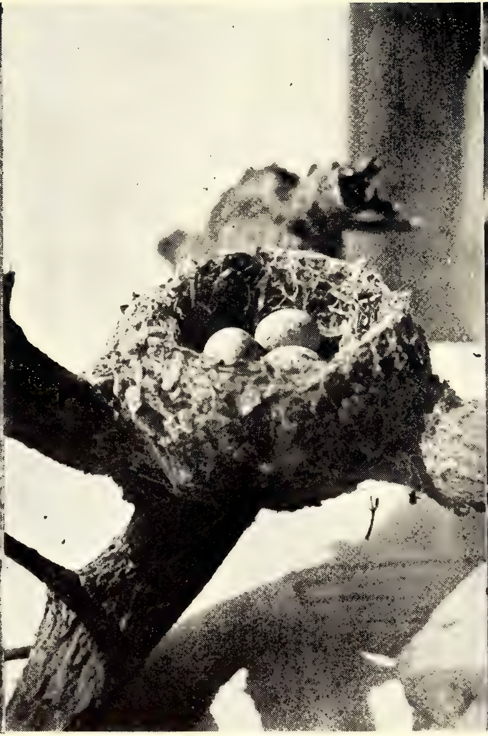
No sooner does the hen commence the work of incubation then the cock ventures forth on his expeditions of murder in order to complete the details of what is generally referred to as the "Butcher Bird's larder." The thought of the coming brood seems to inspire him with abnormal courage, for he makes murderous attacks on all and sundry; insects, reptiles, and young birds alike,—and whatever he can overpower is carried off in a dazed and battered condition to be impaled on thorns in the vicinity of the nest. Not till the larder is well stocked with the tortured and wriggling bodies of numerous victims does this extraordinary criminal cease its efforts. The eggs are not long in hatching, and the victims being in a more or less comatose condition by that time, the young Shrikes have their fresh mutton for the asking.

I will not go so far as to say that this larder is always in evidence. I have examined numerous nests where it was wholly absent, but if one is fortunate enough in finding the nest at the right moment, the larder will usually be found to be well stocked with an indiscriminate collection of young birds, beetles, insects, lizards, and other vermin; which disappear very shortly after the young are hatched. The adult birds then find it such a strenuous business to keep satisfied the voracious appetites of their offspring that the larder, having served its purpose, is discarded altogether.

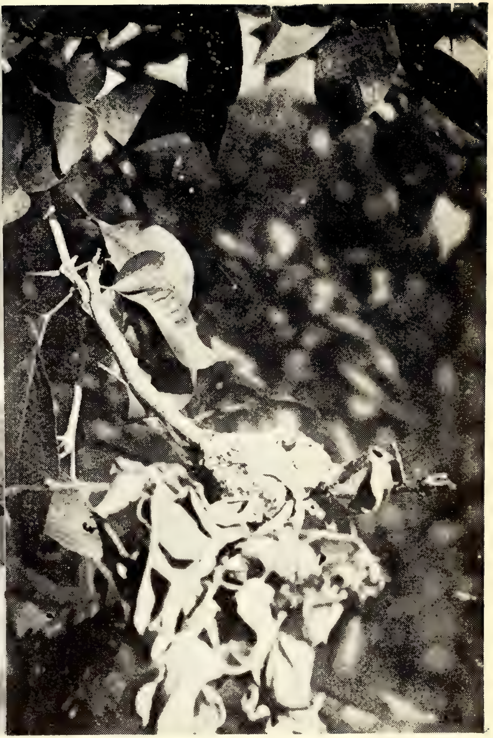
The breeding season in most districts is from March to June, and the nests, as a rule, should only be searched for on babool trees, the various acacias and thorny shrubs. Babool groves scattered over dry open plains are ideal places, and if birds are seen to be haunting the locality during the months mentioned nests are almost bound to occur.



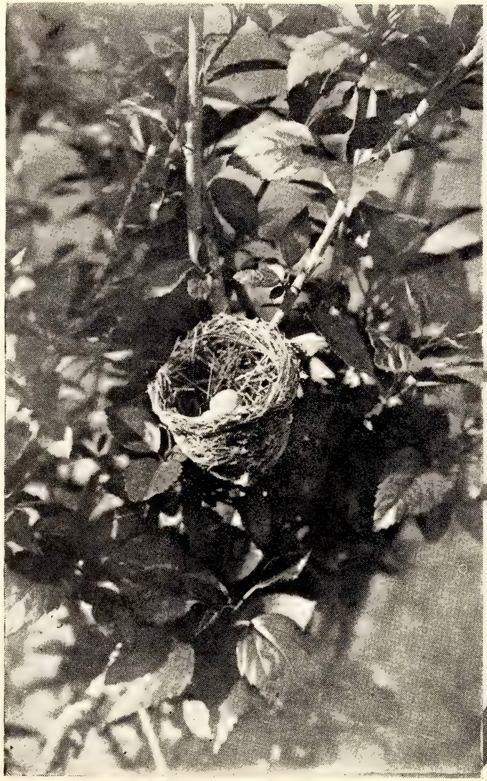
NEST AND EGGS OF THE
INDIAN GREY SHRIKE.
(*Lanius lahtora.*)



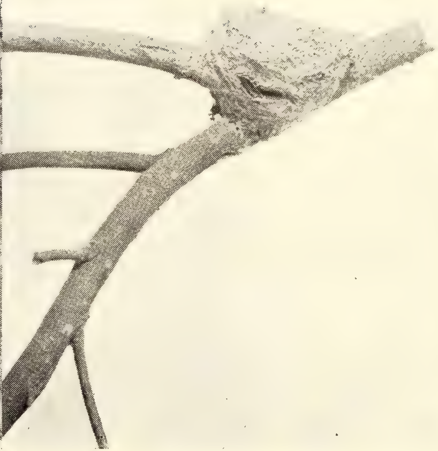
NEST AND EGGS OF THE
COMMON WOOD-SHRIKE.
(*Tephrodornis pondicerianus.*)



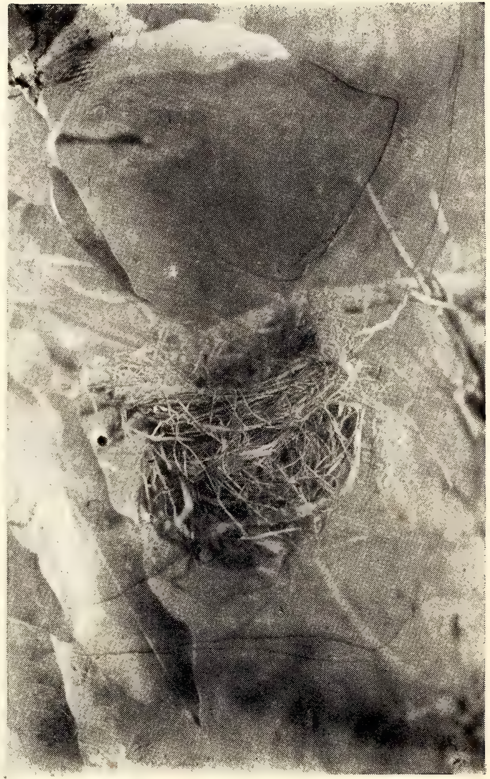
NEST AND EGGS OF THE
SMALL MINIVET.
(*Pericrocotus peregrinus.*)



NEST AND EGGS OF THE INDIAN PARADISE FLY-CATCHER.
(*Terpsiphone paradisi.*)



NEST OF THE WHITE-BROWED FANTAIL FLY-CATCHER.
(*Rhipidura albifrontata.*)



NEST OF THE COMMON ORIOLE.
(*Oriolus kundoo.*)

The nests are fairly typical, being large and more or less solid structures of twigs, grass and various coarse vegetable fibres, protected on the outside by a layer or two of formidable thorny twigs from which rags and rubbish hang downwards and give the nest an untidy appearance. The egg-cavity is cup-shaped, and is lined with an indiscriminate collection of old rags, vegetable fibres, and horse-hair. The nest externally would measure about 7 inches across, with the egg-cavity from 3 to 4 inches in diameter and about 2½ inches in depth. The same nest is often renovated and used for two or three years in succession, and the old nests of Babblers and Crows also appropriated for the purpose. Very little effort is made in the direction of concealment.

The maximum number of eggs laid appears to be six, though it is more usual to find four, sometimes five. In shape they are typically broad ovals, with a tendency to become pointed towards one end. The variation in shape, size and coloration, is considerable; but there is something characteristic about the eggs of this family which renders them unmistakable. The ground-colour varies from a cream to a delicate pale green, some of the lighter shades presenting a distinct pink tinge; and the markings consist of spots, splashes, and cloudy daubs of every conceivable shade of dingy yellow and dingy purple sometimes confined to a ring round the large end, and sometimes scattered over the whole egg in various designs. A normal egg would measure about 1·03 by 0·8 inch.

Lanius vittatus (473)	The Bay-backed Shrike.
Local name	Pachanak.
Anglo-Indian name	The Small Butcher-Bird.

This is the smallest resident species of the genus; and, without being quite the commonest, it certainly seems to have a wider distribution and is found indiscriminately in most districts in all sorts of places; not infrequently in gardens and groves adjoining human dwellings. It is found either singly or in pairs, and, though its ordinary notes resemble the harsh croak so characteristic of the family, it is, when the occasion demands it, capable of melodious warblings and musical chatterings quite pleasing to the ear. Its habits are those of the genus, but it would seem to be less fierce and pugnacious, and, ordinarily, quite a respectable member of society.

Not only does the male bird indulge in song of his own, but he is capable of mimicing the notes of other birds to a very remarkable extent. During the winter months he chatters and warbles spasmodically, but as the summer approaches and the period of nidification draws nearer his vocal powers are brought into action to celebrate the occasion and give expression to his feelings in quaint musical twitterings which are continued for hours at a time. Later, he may be seen to confine his energies to one particular locality which he protects vigorously against intrusion. Having once established himself he may be seen hour after hour, during certain hours of the day, sitting on some favourite perch, and singing as though his little throat would burst; and this is continued day after day till a mate is secured, when the song is heard no more. The more serious business of reproduction allows no time for idle chatterings.

The period of nidification is somewhat prolonged, from about April to September; though the greater number of eggs are found in May, June and July. The nests are neat and compact, and are almost invariably wedged tightly into the angle of a forked branch; preference being given to the various thorny acacias. They are circular in shape with an external diameter of about 5 inches. The egg-cavity is deeply cup-shaped, about 2¼ inches in diameter and 2 inches deep; and the walls of the nest quite an inch in thickness. As a rule, the structure is composed of fine twigs and vegetable fibres, principally tow, closely interwoven, and sometimes wound round externally with spider's web. Internally the nest is sometimes unlined, but is often lined with horse hair, feathers, and cotton wool incorporated in the structure. Old nests are sometimes used.

The maximum number of eggs laid is six, though it is more usual to find four, often only three. Save for the fact that many specimens exhibit a ring of markings round the large end and resemble greatly those of the White-browed Fantail Flycatcher, the eggs, as a rule, are miniatures of those of the last species; a normal specimen measuring about 0·83 by 0·65 inch.

Lanius erythronotus (476) .. .. The Rufous-backed Shrike.
Local name .. .. Mattiya latora.
Anglo-Indian name .. .. .. The Common Butcher-Bird.

This species is comparatively common in the Western districts, very common throughout Bundelkhand and the Submontane tracts, but somewhat scarce in the Eastern districts. Like the Indian Grey Shrike it is a bird of open country and scrub-covered hills; but is often to be found in wooded country and along the banks of streams. Its habits are also similar to those of the Indian Grey Shrike, and though it has the reputation of being bolder, fiercer and more pugnacious, I have not come across a single instance of the presence of a larder near the nest. I have spent a deal of time watching both species in their natural surroundings, and except for the fact that the present species is livelier and more vociferous I do not think that there is much to choose between them in regard to their predatory activities. The following note by Mr. Benjamin Aitkin, taken from Hume's Nests and Eggs of Indian Birds, regarding his observations in the Bombay Presidency, is most interesting. He says, "This Shrike makes its appearance in Bombay regularly during the last week of September, and announces its arrival by loud cries for the first few days, till it has made itself at home in the new neighbourhood; after which it spends nearly the whole of its days on a favourite perch, darting down at every insect that appears in a radius of thirty yards. It pursues this occupation with a system and perseverance to which *L. lahtora* makes but small approach. When its stomach is full, it enlivens the weary hours with the nearest semblance to a song of which its vocal organs are capable; for while human bipeds have a good voice but no ear, the *L. erythronotus* has an excellent ear but a voice that no modulation will make tolerable. It remains in Bombay till the end of February, and then suddenly becomes restless and quarrelsome, making as much ado as the *Koel* in June, and then taking its departure, for what part of the world I do not know. This I know, that from March to August there is never a Rufous-backed Shrike in Bombay."

The breeding season is from March to August, though the majority of nests seem to contain eggs in May and June. The nests are constructed throughout of coarse vegetable fibres and are, as a rule, much tidier, more compact, and more substantial than those of *L. lahtora*. They are usually placed in thorny bushes, sometimes on leafy trees, generally quite low down; and the protecting layer of thorns is only occasionally in evidence. The egg-cavity is deeply cup-shaped but smaller, and the external measurements approximately the same, so that the difference is accounted for by the thickness of the walls which is rather a characteristic feature of the nest. Most nests are well concealed.

It is usual to find three or four eggs in a nest, though five is the full complement laid. In shape, size and character of the markings they vary a good deal; but, generally speaking, are smaller additions of those of *L. lahtora*, save that the markings are scantier and less distinct. A normal specimen would measure about 0·92 by 0·7 inch.

Tephrodornis pondicerianus (488) .. The Common Wood-Shrike.
Local name .. .. Unknown.
Anglo-Indian name .. .. .. Tarti-tuya.

This species occurs throughout the Province, though it is nowhere very common. Summer and winter, in season and out of season, the birds are met with in couples only; a feature which is characteristic of the species, and which leads one to the belief that the couples pair for life. They bear only a structural similarity to the true Shrikes, and in habits resemble more the Minivets as they flit restlessly from branch to branch in quest of the elusive insect.

The period of nidification is comparatively short, March and April being the most favoured months. The nest is comparatively small for the size of the bird, and, as a rule, is difficult of location. It is always wedged tightly into the angle of a forked branch between 10 and 20 feet from the ground, and a great deal of importance is attached to concealment ; the nests being most cunningly concealed amongst thick foliage.

The nests are circular in shape with the egg-cavity comparatively shallow. Some are frail and do not show above or below the branch to any appreciable extent, while others are more substantial with the rim protruding above after the fashion of a Drongo's. They approximate in size to those of the Bay-backed Shrike, but are much more delicate in structure and are composed throughout of delicate grass-roots and vegetable fibres closely interwoven, and held in place with cobwebs with which the nest is thickly coated externally. Internally there is usually a lining of silky vegetable down and fibre.

Both birds share in the labours of nest construction, never resting for a moment till the job is completed, and giving a practical demonstration of energy which is astounding. It often happens that both birds arrive at the nest together with building materials held tightly in their bills, and then it is very amusing to watch the way in which one sits by and waits for the other to finish operations, and then carries on with the job as soon as the other has vacated its position.

The curious plaintive notes of this species, especially in the breeding season, are unmistakable ; so that by watching them foraging for building materials it is not difficult to locate the nest, which is usually completed in a week or ten days.

The full complement of eggs laid appears to be three, and though very Shrike-like in appearance, they can be easily distinguished from them by their darker shades and bolder markings. The ground-colour varies from a cream to a greenish white with spots, specks and splashes of a dull reddish brown, brought into relief by indescriminate shades of dull purple, sometimes scattered over the whole surface of the egg, and sometimes more or less confined to the large end to form an irregular cap or zone. The shells are of fine texture but with no perceptible gloss, and a normal specimen would measure about 0·75 by 0·6 inch.

Pericrocotus peregrinus (500)	The Small Minivet.
Local name	Bulal-chasm.
Anglo-Indian name	Raja-lal.

So far as I am aware, this is the only species of this interesting genus which breeds at all commonly in the plains of the Province. Here we have an instance of a species which under ordinary conditions is sociable enough, quite gregarious in fact; and yet as the period of nidification approaches we find the various parties splitting up into couples, and carrying out in comparative seclusion the laws imposed on them by nature.

They breed from the latter half of February to the beginning of August, according to locality and climatic conditions. In the Eastern districts I have taken eggs early in March, and in the Western districts as late as June and July; so that the period of nidification is somewhat prolonged. Both birds assist in building the nest, while their display of energy is hardly inferior to that exhibited by the Common Wood-Shrike.

The nests are very beautiful and quite typical of the species. They are circular in shape with an external diameter of about 2¼ inches ; the egg-cavity having a diameter of about 1½ inches and a depth of 1 inch. They are, as often as not, wedged in between forked twigs at the end of an overhanging branch quite low down; but are sometimes at considerable heights from the ground. Sometimes they are stuck on to the tops of horizontal branches and in such impossible positions as to be almost inaccessible. They are composed throughout of very fine grass-stems and a certain amount of vegetable fibre wound round with cobwebs to which small bits of dry leaves and bark are found adhering, and which has the effect of making the nests appear as part of the branch itself. The egg-cavity is smooth and cup-shaped while the eggs rest on a comparatively frail bottom which is usually unlined. The nest is really a marvel of construction, and despite its frail and delicate appearance is capable of withstanding the fiercest hot winds of summer.

Normally only three eggs are laid. In shape they are typically broad ovals with both ends very blunt. The ground-colour is a delicate greenish white, while the markings consist of multitudinous spots, specks and blotches, of a reddish brown shade, sometimes scattered all over the egg, and sometimes confined, more or less, to the large end where they have a tendency to form an irregular cap or zone. Secondary markings of a pale purple shade are also noticeable at the large end. The shells are devoid of gloss while the eggs themselves are almost perfect miniatures of those of the Brown-backed Indian Robin. A normal specimen would measure about 0·67 by 0·53 inch.

Campophaga sykesi (508) ..	The Black-headed Cuckoo-Shrike.
Local name	Jungli Kasya.
Anglo-Indian name	The Jungle Warbler.

This pretty little Cuckoo-Shrike is met with at certain times of the year in most districts, though it is nowhere common. In the Eastern districts it seems to make its appearance shortly before the rains, stopping till August and September and then migrating to I know not where. It is met with either singly or in pairs, and as far as my experience goes, I have found it commoner in the forest areas of the Banda and Jhansi districts; though wherever one meets it the loud whistling call notes of the male can hardly fail to attract attention.

As the breeding season approaches the male seems to become exceedingly vociforous and quarrelsome, darting repeatedly at his mate with outspread wings and tail, in the most intimidating fashion, and uttering, all the while, a sharply repeated chattering cry. But as soon as the nest is completed and eggs laid he settles down to a life of contentment and even shares in the work of incubation.

The eggs are laid in July and August and the nest is usually wedged into the angle of a forked branch usually at some considerable height from the ground. It is ridiculously small for the size of the bird, and is almost impossible to distinguish unless the bird is in possession. It is constructed throughout of fine grass-stems coated and bound together exteriorly with cobwebs, and is so frail, as to be comparatively transparent from below. The egg-cavity is quite shallow and devoid of any lining.

Only two eggs are laid. In shape they are moderately broad ovals, obtuse at both ends. The ground-colour is a delicate greenish-white thickly blotched and streaked throughout with shades of pale brown, particularly towards the large end. The shells present a slight gloss, and resemble greatly the eggs of the Magpie Robin. A normal specimen would measure about 0·86 by 0·65 inch.

Graucalus macii (510)	The Large Cuckoo-Shrike.
Local name	Kasya.
Anglo-Indian name	The Rain-Bird.

This species is commonly distributed throughout the Province, and is frequently met with in gardens and groves adjoining human dwellings. The period of nidification is extended over a long period, March to August, though much earlier in the Eastern than in the Western ditricts. I have taken eggs in all these months.

In February and March the birds become extremely garrulous, and it is quite a common sight to see them following one another from tree to tree uttering a quaint melodious warble to the accompaniment of a slight fluttering of wings in mid air; a procedure which is continued in a sitting posture by the alternate rise and fall of each wing.

I have found the nests most commonly on Seesam trees, though the Mango and Mohwa are also favoured, and always at moderate heights from the ground. The nests which are always wedged into the fork of a branch, are small for the size of the bird; thin twigs and grass being used in the structure, and the exterior being rather thickly coated with cobweb. The egg-cavity is sometimes shallow and sometimes moderately cup-shaped, comparatively transparent from below, and usually without regular lining.

The eggs are three in number and rather typical of the species. In shape they are rather elongated ovals, a good deal pointed towards one end. The ground-colour varies between a stone colour and a pale green, and the markings, which are Shrike-like, consist of brownish spots, streaks, and blotches underlaid by indistinct clouds and blotches of pale purple shades. In some the markings are faint and washed out, and in others rich and distinct, reminiscent rather of Tern's eggs; while in some specimens the markings seem to collect in a broad zone at the large end. A normal specimen would measure about 1·26 by 0·9 inch.

Oriolus kundoo (518)	The Indian Oriole.
Local name	Pilak.
Anglo-Indian name	The Golden Oriole; Mango-Bird.

This species is familiar throughout the Province, though to a less extent in the winter months during which period they seem to carry out local migrations and are absent from their usual haunts. They arrive in large numbers in April and May and begin domestic operations about June. The majority of nests contain eggs in June and July.

The nest is well constructed and typical of the species. It is a neat and compact purse like affair suspended between some slender fork at the extremity of one of the high branches of trees such as Tamarind, Seesam, Mango, Peepal, and the like; though there does not seem to be any special preference. The external diameter would measure about 4½ inches with an internal diameter of about 3½ inches and a depth of 2½ inches. It is constructed throughout of hemp-like fibre and lined internally with fine grass-stems closely and neatly interwoven. Some nests are devoid of any extraneous matter, but others have cloth, paper, and all sorts of rubbish incorporated in the exterior. They are always well concealed amongst green foliage while the bird itself fits so exactly into the nest as to be quite invisible from below; so that unless one watches the birds carefully while the nest is in process of construction it is not easy of location.

Four is the maximum number of eggs laid, though it is more usual to find only three. In shape they vary considerably, but typically are moderately elongated ovals tapering a good deal towards one end. The ground-colour is an excessively glossy china white which, when the egg is fresh and unblown, appears a delicate salmon pink on account of partial translucency of the shells. The markings consist, normally, of black spots and specks scattered more or less thinly over the whole egg, particularly towards the large end. A normal specimen would measure about 1·1 by 0·8 inch.

Oriolus melanocephalus (521)	The Indian Black-headed Oriole.
Local name	Pilak.
Anglo-Indian name	The Golden Oriole.

This species is pretty evenly distributed in the Eastern and Western districts alike. It appears to be resident throughout its range from about October to May, after which it seems to migrate further afield, and is less frequently met with. Its colouring is much more vivid and attractive than that of its congener, while its loud, melodious note represented by the word "tiu" often repeated, is alone sufficiently distinctive for purposes of identification.

Its nest and nesting habits are almost identical with those of the Common Oriole, and the same number of eggs are laid, but at a much earlier period; March and April being the most favoured months in the Eastern districts; slightly later perhaps in the Western districts.

In addition to being very beautiful the birds are extremely wary, and if engaged in the work of nest construction one has to watch from quite a respectful distance to be able to observe anything; for neither the male nor female will approach the nest site if at all suspicious of being watched, both birds share in the labours of nest construction and incubation, and are devoted to the nestlings which are easily reared and tamed, and which are worthy acquisitions to any aviary.

The eggs in colour and character are not unlike those of the Common Oriole, save that the dark spots are frequently enveloped in a pinkish nimbus like some of the eggs of the Common Drongo. The shells too are not so glossy, and of a pinkish ground, with the markings not so bold or well defined. As a whole the eggs are slightly larger and measure about 1·14 by 0·82 inch.

Sturnia malabarica (538)	The Grey-headed Myna.
Local name	Desi-pawi.
Anglo-Indian name	Unknown.

I am sure that this curious little Myna is fairly evenly distributed throughout the plains, though personally, I have seen it only in certain parts of Oudh and Ghazipur. As members of a noisy family they are, as a rule, remarkably silent; the call being a curiously subdued disyllabic note uttered only on the wing, or at the moment when flight is commenced. This, added to the fact that their coloration is of a decidedly protective nature, renders them less conspicuous and liable to be overlooked.

In Ghazipur they arrive in very small numbers about November when they are most partial to the fruit of the Peepal and Bargat trees, and the fleshy, scarlet blooms of Silk Cotton trees. As the summer approaches, the numbers seem to increase, till by July and August they may be seen in flocks of 20 or 30 birds, both young and old, haunting the tops of large trees and preparing, as it were, for some migratory flight. They would seem to be essentially arboreal in their habits, for I have never seen them descend to the ground.

In spite of the fact that I have searched diligently for the nests of this species time and again, I have only once succeeded, and that nest was about 50 feet up a gigantic Millingtonia in my compound. It was in a small circular hole bored originally by a Woodpecker or Barbet, and for two previous years it had been inhabited by Paraquets which would have occupied it again on the occasion in question had the Mynas been a little less determined on the matter. The contest between the parties for the possession of the nest waged round it for several days eventually leaving the Mynas victorious.

Once having established possession, the birds set about putting their house in order; a procedure which continued for a fortnight. On the 20th May, after I had allowed sufficient time for the eggs to be laid, the nest hole was opened up with considerable difficulty by my servant, and five eggs discovered placed on a padding of grass, leaves, and a few feathers.

In shape, three were broad, and two moderately elongated ovals more or less pointed towards the small end. The shells were fine in texture and rather glossy, and of a delicate sea green without spot or blemish of any kind. The average measurement was about 0·9 by 0·71 inch.

Temenuchus pagodarum (544) .. .. The Black-headed Myna.
Local name .. .. Pawi.
Anglo-Indian name .. .. .. Pawi.

This bird is one of the most familiar of our resident species and occurs commonly throughout the plains in large or small parties. Its notes are pleasing, and when tamed it becomes quite a good mimic ; in fact it is ordinarily quite domesticated.

Domestic operations are commenced, as a rule, in May and are continued till August ; most nests having eggs in June. The nests are confined exclusively to holes in trees, usually the old and deserted nests of Woodpeckers and Barbets.

The bottom of the nest hole is usually lined with a little grass, dead leaves and a few feathers ; so that its construction does not involve much labour. The work of incubation, however, is shared equally by both birds, which during this period are remarkably courteous to one another.

There is always a great deal of ceremony attaching to the transference of the eggs from the care of one bird to the other. On arrival at the nest hole, the male calls to the female till she joins him on a perch outside the nest. There follows a good deal of bowing and scraping, bobbing of heads, and expanding of crests, accompanied by quaint little guttural sounds quite pleasing to the ear ; and while the male takes possession of the nest the female goes off in search of food. Also it is quite a common sight to see one bird perched just outside the nest and chattering for hours to its mate inside.

The eggs are up to five in number. Typically they are moderately broad ovals pointed towards one end, and of a pale greenish blue colour throughout. The shells are glossy and of fine texture ; and a normal egg would measure about 0·95 by 0·75 inch.

Acridotheres tristis (549) .. .. .. The Common Myna.
Local name .. .. Maina, Desi-maina.
Anglo-Indian name .. .. .. The Common Myna.

This is quite the commonest of our resident species throughout the plains and a familiar garden and aviary bird. All and sundry are familiar with its cheeky demeanour and raucous voice, and there is not much that the man in the street does not know about its ordinary habits.

In this species some of the members are workers and some are not, for the nests are of various designs and built in various places. The most favoured places are holes in trees and walls, especially the spaces beneath the eaves of bungalows, and between the rotating fronds of date-palms. If possible, the same nests are used and added to year after year and a great deal of material used in their construction ; particularly *Nim* twigs, which are piled up in most nests in large quantities. No effort is made to keep these nests clean for they are always savoury and infested with vermin. Old bits of rag and paper are incorporated, and invariably pieces of snake-skin.

Quite frequently the old nests of Crows, Tree-Pies, and Babblers are appropriated and renovated, sometimes at considerable heights from the ground ; while occasionally untidy looking, more or less cup-shaped, nests of sticks are constructed by the birds throughout. The vermin, however, is never absent, and is rather a disgusting characteristic of the species.

The eggs are up to six in number, in shape they are typically rather elongated ovals, often pear-shaped. The shells are brilliantly glossy and vary in colour from pale blue to a pure greenish blue without spot or blemish of any kind. A normal egg would measure about 1·2 by 0·85 inch.

Acridotheres ginginianus (551) .. .. The Bank Myna.
Local name .. .. Ganga Maina.
Anglo-Indian name .. .. .. The Well Myna.

This species is common throughout the plains and differs from the Common Myna in being essentially gregarious in its habits; associating together in parties even while breeding. It is both arborial and terrestrial, and occurs quite frequently in gardens and groves.

It builds exclusively in holes in earthern banks, cliffs and wells, which it excavates for itself to a horizontal depth of 5 or 6 feet. Preference seems to be given to banks and cliffs overhanging running water, and in the more favoured places hundreds of couples may be seen nesting together; the tunnels being only inches apart. I have seen several such places on the Gumti in the Lucknow district, and on the Jumna at Allahabad.

Once a breeding colony is located, the eggs are easy to get at, but I will take this opportunity of giving amateur collectors a solemn warning against putting their hands down these holes even if birds are seen to go in or come out. Some years ago, a friend of mine put the whole of his arm down a nest of this species after seeing the bird emerge, but was bitten by a poisonous snake near the elbow, and very nearly lost his life. The snake was in a side tunnel which bifurcated from the main burrow at right angles, from which position it was later excavated and killed. It is difficult to say how long the reptile had been in occupation, but the circular chamber at the end of the main tunnel contained four Myna's eggs; and I am certain that the Myna was ignorant of the snake's presence as I am certain of its ultimate fate if we had not precipitated matters as soon as we did.

All nest holes, whether they be in trees or earthern banks, should first be opened up with a hatchet or spade, and on no account should a hand be inserted till this is done. The practice is fraught with the gravest danger.

The tunnels, apart from being close together, cross and recross each other in the most amazing fashion. They are just large enough to allow one bird at a time to enter, but the egg-chamber at the other extremity is hollowed out and enlarged and lined with loose grass, feathers, and frequently bits of snake-skin.

This curious habit amongst birds which build in holes of using snake-skin is most interesting, and affords much food for thought. Hume, in discussing the question, formulates a most unique theory. "Are birds superstitious, I wonder? Do they believe in charms? If not, what induces so many birds which build in holes in banks to select out of the infinite variety of things, organic and inorganic, pieces of snake-skin for their nest? They are at best harsh, unmanageable things, neither so warm as feathers, which are ten times more numerous, nor so soft as cotton or old rags, which lie about broadcast, nor so cleanly as dry twigs and grass. Can it be that snakes have any repugnance to their worn out weeds, that they dislike these mementos of their fall,* and that birds which breed in holes, into which snakes are likely to come, by instinct select these exuviæ as snake-scares?"

The period of nidification is from April to July, though the most favoured month seems to be May. The eggs are four in number, occasionally five, and as a rule are shorter and proportionally broader than those of the Common Myna. They are of the usual Myna type, very glossy and of various shades of pale and greenish blue. A normal egg would measure about 1·0 by 0·82 inch.

Sturnopastor contra (555)	The Pied Myna.
Local name	Ablaki Maina.
Anglo-Indian name	Abulka.

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* "When the snake," says an Arabic commentator, "tempted Adam, it was a winged animal. To punish its misdeeds the Almighty deprived it of wings, and condemned it thereafter to creep for ever on is belly, adding, as a perpetual reminder to it of its trespass, a command for it to cast its skin yearly."

The Pied Myna is also a common resident species throughout the plains and breeds throughout its range. It differs from its congeners not only in regard to colouring, which is most marked, but also as regard nidification; for it departs from the general custom of the tribe and builds itself a large untidy nest of grass, twigs, rags and straw, placed conspicuously at the extremity of some lateral branch for all the world to see and admire; provided, of course, that sufficient enthusiasm can be mustered for the purpose.

These wonderful nurseries, in regard to which a great deal of ingenuity is displayed in putting the loose material together, vary somewhat in size and shape. Some are more or less globular, while others conform to no particular shape whatsoever; being about 24 inches long by 18 inches broad. In the centre is a well-like cavity the entrance to which is sometimes on top, and some times to one side; and the bottom of this is is lined with fine grasses and feathers to form a circular egg-cavity about 3½ inches in diameter.

The nests are placed from 15 to 40 feet from the ground on any old tree or acacia in the vicinity, and there is no attempt at concealment. They are almost invariably in the vicinity of human dwellings, and are unmistakable on account of their external untidiness; looking like shapeless trusses of hay with untidy streamers of straw and old rags floating in the breeze. The period of nidification is from May to July, and it is not uncommon to see more than one nest on the same tree.

The eggs are up to five in number. In shape they are moderately broad ovals, a good deal pointed towards one end; many specimens being more or less pear-shaped. The shells are brilliantly glossy and vary in colour from a delicate to a pure sky blue, occasionally tinged with green. A normal egg would measure about 1·1 by 0·82 inch.

Having described the nesting habits of the Common Mynas it will be interesting to note the idiosyncracies obtaining among so few species of the one family. While the Black and Grey-headed Mynas build exclusively in holes in trees, the Bank Myna resorts to holes in the ground, congregating in large numbers for purposes of security. The Common Myna does not seem to have quite made up his mind on the matter, for while some resort to holes in trees, a few make their own nests, while others take the line of least resistance and appropriate other nests. The Pied Myna, on the other hand, is quixotic; and departing absolutely from the general custom, builds himself a nest of straw and grass and is no mean craftsman at the art of weaving. It would seem that ornithologists have yet quite a lot to learn.

Terpsiphone paradisi	..	..	The Indian Paradise Flycatcher.
Local name ..	..	..	Sultana Bulbul.
Anglo-Indian name	..	..	The Indian Bird of Paradise.

During the winter months this attractive bird occurs in most districts and is frequently met with in gardens and groves adjoining human dwellings. Unfortunately, the bulk seem to migrate in summer to the Sub-Himalayan tracts, but a great many remain behind and breed sparingly throughout the plains. I have found eggs as regularly in the Eastern as in the Western districts.

The breeding season is in May and June, though in the Western districts it is carried forward to July. The nests are somewhat typical of the species, and are not difficult to locate if the nesting birds are carefully watched. A great deal of importance, however, is paid to concealment, with the result that trees with thick foliage would seem to be specially favoured.

A favourite nesting site is the end of a leafy, overhanging branch from 20 to 30 feet from the ground, and these are always the most difficult to negotiate. The branch is usually too thin to bear any weight and is out of reach from below; so that the eggs have to be fished out from above with the help of a spoon-shaped instrument attached to a fine pole, and then dropped into a sheet or fine net stretched out carefully beneath. I have personally had to resort to this method on several occasions.

Sometimes the nests are low down and easy to get at, especially when placed on the flat upper surface of some horizontal bough at a point where some fine twig rises perpendicularly; the twig being incorporated in the structure of the nest. But as a rule they are fairly high up, and are found more commonly in the vicinity of water, especially running streams.

The nest is a delicate cup-like affair, not unlike a larger addition of the Common Iora's; and when placed at the extremity of some overhanging branch is often cone-shaped, with the apex downwards. It is composed of fine grasses and vegetable fibres closely interwoven and plastered externally with a good deal of cobweb. The egg-cavity is usually lined with fine twigs and horsehair, and measures about 2½ inches in diameter by 1½ inches in depth. The walls are thin and delicate, and seldom exceed a quarter of an inch in thickness. The whole structure is as delicate and pleasing in outline as it is effective in design.

The full complement of eggs laid is four, but it is more usual to find only three. In shape they are typically rather long ovals, somewhat pointed towards one end; and, generally speaking, are miniatures of the salmon-tinted types of the Black Drongo. The ground-colour varies from a very delicate pink to a warm salmon-pink, while the markings consist of spots and small blotches of a reddish brown shade sprinkled over the whole egg, but more usually towards the large end where they have a tendency to form an irregular cap. A normal egg would measure about 0·8 by 0·6 inch.

Rhipidura albifrontata (604) ..	The White-browed Fantail Flycatcher·
Local name	Chak-dil.
Anglo-Indian name	The Fantail Flycatcher.

This fascinating little species is comparatively common throughout the plains. It is met with either singly or in pairs, and often may be seen fitting about gardens and groves in search of insects which it captures on the wing. Ordinarily, however, it is more frequently met with in shady groves, Mango especially, where its high pitched whistling notes are heard to great advantage.

The period of nidification is from March to August, according to locality. The nests are wonderful structures almost invariably stuck firmly on to the upper surface of some horizontal branch, usually quite low down. It is circular in shape with an external diameter and depth of 1½ and 1 inch respectively, and the surrounding walls are rarely more than a quarter of an inch in thickness, with the bottom of the egg-cavity slightly more. It is constructed throughout of very fine grass-stems held in place by a thick external coating of cobwebs. The egg-cavity is usually unlined.

Both birds seem to share in the labours of nest construction, but incubation seems to be carried out by the hen alone; though the male is always in the vicinity flitting about and whistling incessantly. Sometimes uttering harsh Shrike-like notes and mobbing with deliberate intent any other bird trespassing within his boundaries, and never ceasing in his efforts till the intruder has departed.

Only three eggs are laid, the greater number of which are almost perfect miniatures of the Bay-backed Shrikes. In shape, they are moderately broad ovals, a good deal compressed towards one end. The ground-colour varies between pure white and a dingy cream colour, and the markings, which are almost invariably confined to a zone at the large end, are made up of spots and specks of a darker shade of greater or less intensity. A normal egg would measure about 0·6 by 0·5 inch.

(*To be continued.*)

A HAND-LIST OF THE SNAKES OF THE INDIAN EMPIRE.

By

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Some time before Mr. Kinnear relinquished the appointment of Curator to our Society's collections, he appealed to me to compile a list of the Snakes of British India, and bring it up to date. The standard work on the Snakes of India appeared in 1890 under the title "Fauna of British India, Reptilia and Batrachia" for which Mr. G. A. Boulenger, F.R.S., of the British Museum was responsible. From 1893 to 1896 the "Catalogue of Snakes in the British Museum" appeared in the large volumes which were compiled by the same Author. Since this time no other work on the Indian Snakes has been published, but a great many notes and papers have been contributed to various scientific journals by workers in this branch of natural history, and, as was to be expected, many species have been discovered that were not known when the "Catalogue" appeared. These facts, it is felt, justify the list now presented.

I have been considerably exercised in mind just how much or how little to incorporate in a list of this kind. As it is written for the field naturalist it is desirable that all that may be useful to him should be included that is consistent with brevity. I have therefore restricted my remarks chiefly to modifications or amplifications to the text of the Fauna of British India, Reptilia and Batrachia, and enumerated all the new species that have been discovered since that work was published.

With regard to scientific nomenclature I am on delicate ground. When two of our greatest stars in the Zoological firmament are frequently in disagreement over precisely the same data—Mr. Boulenger in the British Museum and Mr. Stejneger in the United States National Museum at Washington—one is driven to the conclusion that one or other at times flagrantly disregards the international rules of Zoological nomenclature, or what is more probable, that the rules as laid down are so intricate as to admit of a dual interpretation.

It is extremely annoying to all workers in Zoology to have names upset with which they have grown familiar. In some instances therefore where there appears to me uncertainty I adhere to the names English herpetologists have learnt through Boulenger's Catalogue. In other instances where there appears to me no doubt that he is in error, I have adopted the nomenclature as corrected by

Stejneger. It is high time that the correct names in every case were fixed by an international tribunal from which there should be no appeal. Until that happy day we shall never be safe from perpetual change with the advent of every new book. In the sub-family *Hydrophinae* I have introduced many new genera and revived others that have fallen into disuse. In support of my action I have given a history of the genus wherever it has been changed.

Mr. Spence, with whom I have discussed most points in this paper, wished me to give an English as well as a Scientific name to the various species. I have found it extremely difficult in most cases to suggest an appropriate English name. In many cases I have adopted the English rendering of the scientific name, but in many other cases I have overcome the difficulty by attaching to the species the name of its discoverer, or the herpetologist who described it.

With regard to bibliography, I have only referred to publications concerning collections of snakes made in British India with which I include Ceylon, Baluchistan, the North-West Frontier, Kashmir, the Himalayas, Assam, Burma and Tenasserim to the Isthmus of Kra. I have purposely excluded papers and volumes appertaining to collections from other tracts, which however may include species that occur in British India. Further my references only deal with literature which has appeared since the Fauna of British India, Reptilia and Batrachia in 1890.

In recording the measurement of snakes I give these according to the metrical system, and the duodecimal system, as so many of us are not yet accustomed to the former method.

In the domain of lepidosis I have given the ranges of costals, ventrals and subcaudals that are known for each species up to date. Similarly with distribution I have recorded the extended ranges known up to date.

My spelling of names of places has been taken from the most recent maps published by the Geological Survey of India.

Past experience leads me to expect adverse criticism from many quarters concerning my conception of a species in such genera as *Dendrelaphis*, *Dendrophis*, *Dipsadomorphus* and *Bungarus*. However until the Gods on the zoological Olympus can lay down a hard and fast definition of a species, it must happen that many more men like myself will hold considerably diverse opinions on this subject. Having dabbled in many branches of biology, including mammalia, aves, and reptilia, lepidoptera and diptera in the zoological domain, and flowers, ferns, and fungi in the vegetable, I have gained some knowledge of the conception of a species in these various fields.

My conception of a species among reptilia was largely acquired in the first place from Mr. Boulenger's works already referred to. One can gauge this Authority's conception of a species for instance by studying his treatment of the genus *Silybura.* Many of the species recognised by him as such, are only distinguished by extremely minute differences affecting the relative measurements of certain head shields. Such minutiæ must appear trifling to anyone but an expert. I fully concur with Mr. Boulenger's views, however, regarding this genus and recognise all the species enumerated by him as such. I consider that the species of the genera mentioned above, and recognised as such by me, are based on far more convincing differences than those seen in many species of *Silybura.*

The compilation of this list could only be made complete and up to date through kind help from others. Dr. Annandale has sent me repeatedly for some years every specimen in the Indian Museum I have wished to inspect, many of which had aroused doubts as to identity or recorded locality. Mr. Spence has extended me the same service so far as the Bombay collection is concerned. Dr. Pearson has given me similar assistance with regard to the collection in the Colombo Museum. In addition I have examined many minor collections in the Madras Museum, Karachi Museum, Travancore, etc., etc., and many private collections. As a result I have been able to investigate all the available specimens of the families *Typhlopidæ*, *Glauconiidæ*, *Uropeltidæ*, *Ilysiidæ*, and *Amblycephalidæ* and revise all genera such as *Dendrophis*, *Dendrelaphis*, *Oligodon*, *Contia*, etc., etc., of the *Colubridæ*. This has enabled me to check the work of other herpetologists and correct many of their mistakes as well as my own. To Miss Procter my greatful thanks are due. In spite of the heavy burden of work confronting her in the British Museum, she was kind enough to find time to give me extended ranges affecting lepidosis and distribution of the Indian species, which have come to light since the publication of the "Fauna of British India, Reptilia and Batrachia."

The first number attached to each species is the serial number of the list. The second number in parenthesis is that attached to the species in the "Fauna of British India, Reptilia and Batrachia."

Family.—1 TYPHLOPIDAE.

Genus.—Typhlops Oppel.

1. (*Nil.*) **Typhlops oligolepis** Wall. *Walls' Blind Snake.*

T. oligolepis. *Wall, Bomb. N. H. J. Vol XIX, p* 339

Type.—In the British Museum. From Nagri Valley.

Length.—142 mm. (5⅝ inches.)

Lepid.—Costals. In 16 rows.

Distn.—*Eastern Himalayas.* Sikkim. (Nagri Valley, circa 5,000 feet. (F. W.) Singla, Darjeeling Dist. 5,000 feet. (Ind. Mus.)

Note.—I have seen three specimens. Miss Procter tells me she cannot trace the type sent by me to the British Museum.

2. (*Nil.*) **Typhlops mackinnoni** Wall. *Mackinnon's Blind Snake.*

T. porrectus. *Sclater, List. Sn. Ind. Mus.* 1891, *p* 2. (*No* 6916).

T. mackinnoni. *Wall, Bomb. N. H. J. Vol XIX, p* 805; *l.c. Vol. XXI, p* 278.

T. venningi. *Wall, Bomb. N. H. J. Vol XXII, p* 515.

Types.—The types of both *mackinnoni* and *venningi* are in the British Museum. The former is from Mussoorie and the latter from Pyawbwe.

Length.—270 mm. ($10\frac{5}{8}$ inches). Diameter $\frac{1}{40}$ to $\frac{1}{70}$ the total length.

Lepid.—Costals. In 18 rows.

Distn.—*N. W. Frontier.* Malakand. (Ind. Mus.) *Western Himalayas* Amber, (? Amb.) N. E. of Murree. Simla. Bhim Tal. (Ind. Mus.) Mussoorie. (F. W.) *Peninsular India.* Punjab. (Lahore. Ind. Mus.) U. P. (Barabanki. Ind. Mus.). Bengal. Calcutta. (Ind. Mus.). *Burma.* Pyawbwe, Shan States. (F. W.)

3. (278) **Typhlops porrectus** Stoliczka. *Stoliczka's Blind Snake.*

T. porrectus. *Boulenger, Cat. Vol I,* 1893, *p* 19; *Sarasin, Zool. Jahr Jena.* 1910, *p* 141; *Wall, Bomb. N. H. J. Vol XXI, p* 278.

Length.—234 mm. ($9\frac{1}{4}$ inches). Diameter $\frac{1}{51}$ to $\frac{1}{83}$ the total length.

Lepid.—Costals. In 18 rows.

Distn.—*Western Himalayas.* Mussoorie. (Quetta Mus.). *Eastern Himalayas.* Darjeeling Dist. (Ind. Mus.). *Peninsular India.* Bengal. (Calcutta Ind. Mus.). Alipore (Bombay colln.). Behar (Pusa. Ind. Mus.). Guzerat. (Ahmedabad. F. W.). Sind. (Karachi. F. W.) C. P. (Nagpur F. W.). Western Ghats. (Bombay. Travancore. Brit. Mus.). Bangalore. (F. W.). *Ceylon.* Punduloya. (Brit. Mus.).

Note.—The Snake referred to by Sclater (*List. Sn. Ind. Mus.* 1891, *p* 2) is *mackinnoni* Wall. Miss Procter tells me there are two specimens labelled *porrectus* in the British Museum from Punduloya, Ceylon.

4. (272) **Typhlops beddomei**, Boulenger. *Beddome's Blind Snake.*

T. beddomii. *Boulenger, Cat. Vol I,* 1893, *p* 18; *l.c. Vol III,* 1896, *p.* 585; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 140; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 2; *Wall, Bomb. N. H. J. Vol XXVI, p* 556.

Length.—140 mm. ($5\frac{1}{2}$ inches). Diameter $\frac{1}{20}$ to $\frac{1}{40}$ the total length.

Lepid.—Costals. In 18 rows.

Distn.—*Western Ghats.* Nilgiris. Anamalais. Cochin. Travancore. Tinnevelly. *Eastern Ghats.* Vizagapatam.

5. (280) **Typhlops mirus** Jan. *Jan's Ceylon Blind Snake.*

T. mirus. *Boulenger, Cat. Vol I,* 1893, *p* 52; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 127; *Wall, Oph. Tap.* 1921, *p* 7.

Length.—140 mm. ($5\frac{1}{2}$ inches). Diameter $\frac{1}{36}$ to $\frac{1}{60}$ the total length.

Lepid.—Costals. In 18 rows. The nasals sometimes fail to meet behind the rostral.

Distn.—*Ceylon.* Peradeniya. (Ind. Mus.).

Note.—I have examined five specimens, four of which are in the Indian Museum, and one in the Colombo Museum.

6. (281) **Typhlops andamanensis** Stoliczka. *The Andaman Blind Snake.*

T. andamanensis. *Annandale, J. A. S., Beng.,* 1905, *p* 175; *Boulenger Cat. Vol I.* 1893, *p* 52.

Length.—165 mm. ($6\frac{1}{2}$ inches). Diameter ^{1} the total length.

Lepid.—Costals. In 18 rows.

Distn.—Andaman Islands.

7. (271) **Typhlops braminus** (Daudin.) *The Common Blind Snake.*

T. psammophilus. *Annandale, Men. A. S. Beng. Vol* 10, *p* 193 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137.

T. braminus. *Annandale, J. A. S., Beng.,* 1905, *pp* 173 *and* 175; *Boulenger, Cat. Vol I,* 1893, *p* 16 ; *l.c. Vol III* 1896, *p* 584; *P. Z. S.* 1919, *p.* 270; *Ferguson, Bomb. N. H. J. Vol X, p.* 69; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 132; *Sclater, List.. Sn. Ind. Mus.* 1891 *p* 1; *Wall, Bomb. N. H. J Vol XVIII, p* 104 ; *l.c. Vol XIX, p.* 609 ; *l.c. Vol XXV, p* 378; *Oph. Tap.* 1921, *p* 9 *Spol. Zeylan.* 1921, *p* 396.

T. fletcheri. *Wall, Bomb. N. H. J. Vol XXVI, p* 556.

Length.—170 mm. ($6\frac{7}{8}$ inches). Diameter $\frac{1}{34}$ to $\frac{1}{55}$ the total length.

Lepid.—Costals. In 20 rows.

Distn.—*S. America.* Mexico. *Africa.* South of the Equator. *S. Asia.* Arabia to S. China and Coastal Islands. *Islands of the Indian Ocean.* Madagascar. Comoro. Mauritius. Cocos. Ceylon. Andamans. *Malay Archipelago.* Java. Borneo. Celebes. *Pacific Islands* Ceram. Philippines. Guam. Formosa. Loo Choos.

Note.—I have recently had a specimen from Bangalore, and examined another in the Karachi Museum in which the suture from the nostril passes to the 2nd labial on one side, being normal on the other. In consequence I can no longer consider *T. fletcheri* a distinct species

8. (*Nil.*) **Typhlops limbricki** Annandale. *Limbrick's Blind Snake.*

T. limbricki. *Annandale, Mem. A. S. Beng. Vol I, No* 10, *p* 193 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137.

Types.—In the Indian Museum. Collected at Ramnad.

Length.—72 mm. ($2\frac{7}{8}$ inches). Diameter $\frac{1}{30}$ the total length.

Lepid.—Costals. In 20 rows, not 18 as given in the description.

Distn.—*South India.* Ramnad. Marikuppam. (Ind. Mus.).

Note.—I consider this a very dubious species differing from *braminus* only in its stouter habit. I make the diameter about $\frac{1}{30}$ the total length in both type specimens, and in view of the great range of variation in this respect seen in *acutus,* and other species, I think it may have to be united with *braminus.*

9. (*Nil.*) **Typhlops thurstoni** Boettger. *Thurston's Blind Snake.*

T. thurstoni. *Boulenger, Cat. Vol I.,* 1893, *p* 26; *l.c. Vol III.,* 1896, *p* 585; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137; *Wall, Bomb. N. H. J. Vol XXVI, p* 556.

Length.—240 mm. ($9\frac{1}{2}$ inches). Diameter $\frac{1}{45}$ to $\frac{1}{52}$ the total length.

Lepid.—Costals. In 20 rows.

Distn.—*Western India.* South of Goa. From sea level, (Trichur. Ind. Mus.) to about 4,000 feet. (Wynad. Nilgiris).

Note.—I have examined three examples.

10. (274) **Typhlops jerdoni** Boulenger. *Jerdon's Blind Snake.*

T. diversiceps. *Annandale, Rec. Ind. Mus.* 1912, *pp* 37, 44 *and* 53.

T. jerdoni. *Boulenger, Cat. Vol I.,* 1893, *p* 19; *l.c. Vol III,* 1896, *p* 418; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 2; *Wall, Bomb. N. H. J. Vol XIX, p* 338; *l.c. Vol XXVI,* p 865.

Length.—298 mm. (11·7 inches). Diameter ^{1} to $\frac{1}{56}$ the total length.

Lepid.—Costals. In 22 rows.

Distn.—*Eastern Himalayas* Buxa Dooars. (Ind. Mus.) Darjeeling Dist. (F.W.). *Assam Hills.* Abor. Khasi. (Ind. Mus.). *Burma.* Pegu. (? Hills. Bombay colln.) N. Shan States. (Lashio. Ind. Mus.)

11. (273) **Typhlops leucomelas** Boulenger. *The Pied Blind Snake.*

T. leucomelas. *Boulenger, Cat. Vol. I,* 1893, *p* 18; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 127; *Wall, Oph. Tap.* 1921, *p* 13.

Length.—130 mm. ($5\frac{1}{8}$ inches). Diameter $\frac{1}{23}$ to $\frac{1}{32}$ the total length.

Lepid.—Costals. In 22 rows.

Distn.—*Ceylon.* Near Galle.

Note.—Only two specimens known, the type in the British Museum, and one discovered by me in the Colombo Museum, locality not on record.

12. (282) **Typhlops tenuicollis** (Peters.) *Peters's Blind Snake.*

T. tenuicollis *Boulenger, Cat. Vol I* 1893, *p* 37.

Length.—365 mm. (1 foot, $2\frac{3}{8}$ inches.)

Lepid.—Costals. In 22 rows.

Distn.—*Himalayas.* (Exact locality not specified.)

Note.—Known from a single specimen.

13. (279) **Typhlops theobaldianus** Stoliczka. *Theobald's Blind Snake.*

T. theobaldianus. *Boulenger, Cat. Vol* I, 1893, *p* 26; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 3.

Type.—In the Indian Museum. Locality not known.

Length.—346 mm. (1 foot, $1\frac{5}{8}$ inches). Diameter $\frac{1}{70}$ the total length.

Lepid.—Costals. In 22 rows. No 6888 in the Indian Museum, 346 mm. in length, has the suture above the nostrils complete. In No 8723 which is 317 mm. in length, the suture above the nostril fails to reach the rostral.

Distn.—*Assam.* Samaguting. Lat. 25·8°. Long. 93·8°. (Ind. Mus.)

Note.—Only two specimens are known, and both are in the Indian Museum.

14. (275) **Typhlops oatesi** Boulenger. *Oates's Blind Snake.*

T. oatesi. *Annandale, J. A. S., Beng.* 1905; *p* 175; *Boulenger, Cat. Vol. I.* 1893, *p* 23.

Types.—In the British Museum.

Length.—200 mm. ($7\frac{7}{8}$ inches). Diameter $\frac{1}{24}$ the total length.

Lepid.—Costals. In 24 rows.

Distn.—*Andamans, Cocos Islands.*

Note.—I have examined all the *Typhlops* in the Indian Museum, but could not trace the specimen referred to by Annandale from the Cocos Islands.

15. (277) **Typhlops bothriorhynchus** Günther. *Gunther's Blind Snake.*

T. bothriorhynchus. *Boulenger, Cat. Vol I,* 1893, *p* 23.

Types.—In the British Museum, labelled Penang. (Cantor.)

Length.—160 mm. ($6\frac{1}{2}$ inches). Diameter $\frac{1}{30}$ the total length.

Lepid.—Costals. In 24 rows.

Distn.—*Assam. N. W. India.* ?

Note.—The locality of the type (Penang) is open to the strongest doubts. At least six other snakes from Peninsular India are recorded from the Malay Peninsular on the sole authority of Cantor. These are *Polyodontophis sagittarius, Helicops schistosus, Xenochrophis cerasogaster, Zamenis fasciolatus, Hypsirhina sieboldi,* and *Bungarus caeruleus.* Stoliczka records it from Hardwar in the N. W. Provinces. I have not been able to trace the specimen which is not in the British Museum, nor in the Indian Museum.

HAND-LIST OF SNAKES OF THE INDIAN EMPIRE.

Corrigenda.

Vol. XXIX—page 351.

For Family " *Glauconiidæ*" read " *Leptotyphlopidæ* " Loc. cit. for " *Glauconia* " read " *Leptotyphlops.*"

Stejneger and Barbour in their check list of North American Amphibians and Reptiles (2nd Edition) 1923, page 79, accept Fitzinger's *Leptotyphlops* (Sept. Report 1843, page 24) type *nigricans.* This clearly precedes Gray's *Glauconia* which dates from 1845. The change in the name of the genus necessitates a change in the name of the family.

16. (276) **Typhlops diardi** Schlegel. *Diard's Blind Snake.*

T. bothrioryhnchus. *Sclater, List. Sn. Ind. Mus.* 1891, *p* 2.

T. diardi. *Annandale, J. A. S. Beng.*, 1904, *p* 207; *Rec. Ind. Mus.* 1912, *pp* 37, 44 and 53 ; *Boulenger, Cat. Vol I*, 1893, *p* 22; *Rec. Ind. Mus.* 1913, *p* 337; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 146; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 2; *Venning, Bomb. N. H. J. Vol XX, p* 770 ; *Wall and Evans, Bomb. N. H. J. Vol XIII, pp* 352 *and* 620; *Wall, Bomb. N. H. J. Vol XVIII, p* 314 ; *l.c. Vol XIX, pp* 609, 757a *and* 898 ; *l.c. Vol XXV, p* 381.

Length.—430 mm. (1 foot, 5 inches). Diameter $\frac{1}{29}$ to $\frac{1}{5}$ the total length.

Lepid.—Costals. In 24 to 26 rows.

Distn.—Eastern Himalayas. Bengal. Assam. Hills and plains North and South of the Brahmaputra. *Burma.* Hills and plains. Tenasserim Dist. (Moulmein. Ind. Mus.) *Siam. Cochin-China.*

17. (*Nil*) **Typhlops tephrosoma** Wall. *The Grey Blind Snake.*

T. tephrosoma. *Annandale, Rec. Ind. Mus.* 1912, *pp* 37, 44 *and* 53; *Wall, Bomb. N. H. J. Vol XVIII, p* 314.

Type.—In the British Museum?. From the Khasi Hills.

Length.—190 mm. (7½ inches). Diameter $\frac{1}{34}$ the total length.

Lepid.—Costals. In 28 rows.

Distn.—Assam. Abor Hills. (Janamukh. Ind. Mus.) Khasi Hills. (Shillong. F. W.)

Note.—Miss Procter tells me she has not been able to trace the type sent by me to the British Museum.

18. (283) **Typhlops acutus** (Dumeril and Bibron.) *The Indian Beaked Blind Snake.*

T. acutus. *Annandale, J. A. S. Beng.*, 1904, *p* 208 ; *l.c.* 1905, *p* 209; *Boulenger, Cat. Vol I*, 1893, *p* 56; *Sarasin, Zool. Jahr. Jena.* 1910 *p* 141; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 3; *Wall, Bomb. N. H. J. Vol XV, p* 377 *l.c. Vol XVI, p* 292.

Length.—610 mm. (2 feet). Diameter $\frac{1}{30}$ to $\frac{1}{60}$ the total length.

Lepid.—Costals. In from 28 to 34 rows.

Distn.—Peninsular India. South of the Ganges Basin, and South of Rajputana.

Family.—GLAUCONIIDAE.

Genus.—GLAUCONIA Gray.

19. (284) **Glauconia blanfordi** Boulenger. *Blanford's Blind Snake.*

G. carltoni. *Barbour, Bull. Mus. Harv. Coll. Vol LI, No* 12, *p* 316.

G. blanfordi. *Alcock and Finn, J. A. S. Beng.* 1896, *p* 561; *Annandale, J. A. S., Beng.* 1905, *p* 209; *Boulenger, Cat. Vol I*, 1893, *p* 66; *Wall, Bomb. N. H. J. Vol XX, p* 1033.

Length.—247 mm. (9¾ inches). Diameter $\frac{1}{55}$ to $\frac{1}{75}$ the total length.

Lepid.—Costals. In 14 rows.

Distn.—Punjab. Amballa. (Barbour) Multan. (F. W.) *Sind.* Kotri. (No 14317. Ind. Mus.) *N. W. Frontier.* Jamrud. (F. W.) *Baluchistan* (Nos 14230 and 14231. Ind. Mus.).

Note.—The very slight departure (1–55) of Barbour's *carltoni* from the diameter reported by Boulenger for the two types of *blanfordi* (1–60 to 1–70), is too trivial a basis upon which to establish a new species and there is no other obvious difference between this and *blanfordi*.

I have now examined six specimens with the diameter ranging between the above specified limits.

20. (*Nil.*) **Glauconia macrorhynchus** (Jan.) *Jan's Beaked Blind Snake.*

G. blanfordi. *Annandale, J. A. S. Beng.*, 1905, *p* 209 (*part*) ; *Sclater. List. Sn. Ind. Mus.* 1891, *p* 4. (*Nos* 12014, 12016 *and* 12017. No. 12015 *is now in a state of dissolution.*)

G. macrorhynchus. *Boulenger, Cat. Vol I*, 1893, *p* 61 ; *Wall, Bomb. N. H. J. Vol XVIII, p* 796.

Length.—234 mm. (9¼ inches) Diameter $\frac{1}{81}$ to $\frac{1}{113}$ the total length.

Lepid.—Costals. In 14 rows.

Distn.—*Sind.* Karachi. (Ind. Mus.) *Baluchistan.* Quetta. (No 14729. Ind. Mus.) *Persia.* Maidan Mihaftan. Falujah. Euphrates. (Bombay colln.) Bushire. (No 8405. Ind. Mus.) *N. Africa.* Nubia.

Note.—I have examined eight specimens, and can find no differences in the lepidosis between this and *G. blanfordi.* Its entity as a species depends, therefore, entirely on its more slender configuration, and the beaked condition of the snout.

Family.—BOIDÆ.

Subfamily.—PYTHONINÆ.

Genus.—PYTHON Daudin.

21. (286) **Python molurus** (Linné.) *The Indian Python.*

P. reticulatus. *Editors, Bomb. N. H. J. Vol XIII, p* 718.

P. molurus. *Abercromby, Sn. of Ceylon*, 1910, *pp* 35, 49 *and* 67 ; *Spol. Zeylan.* 1911, *p* 206 ; *Boulenger, Cat. Vol I*, 1893, *p* 87 ; *l.c. Vol III*, 1896, *p* 418; *Begbie, Bomb. N. H. J. Vol XVII, p* 1021 ; *Cadell, Bomb. N. H. J. Vol XXII, p* 202; *Channer, Bomb. N. H. J. Vol IX, p* 491; *D'Abreu, Bomb. N. H. J. Vol XXV, p* 509; *Evans, Bomb. N. H. J. Vol XVI, p* 519; *Ferguson, Bomb. N. H. J. Vol VI, p* 424 ; *l.c. Vol X p* 69; *Forsyth, Bomb. N. H. J. Vol XXI, p* 277; *Hagenback, Spol. Zeylan.* 1905, *p* 197; *Inverarity, Bomb. N. H. J. Vol VIII, p* 405; *Millard, Bomb. N. H. J. Vol XIV, p* 395 ; *l. c. Vol XVI, p* 758 ; *Pearless, Spol. Zeylan.* 1909, *p* 54 ; *Phipson, Bomb. N. H. J. Vol I, p* 165; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 131; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 4; *Stewart, Bomb. N. H. J. Vol XXV, p* 150 ; *Wall and Evans, Bomb. N. H. J. Vol XIII, pp* 349 *and* 617; *Wall-Rec. Ind. Mus.* 1907, *p* 155 ; *Bomb. N. H. J. Vol XIX, pp* 340 *and* 610 ; *l. c. Vol XXI, p* 447 ; *l. c. Vol XXVI, p* 862, *Oph. Tap.* 1921, *p* 48.

Distn.—*Ceylon. Peninsular India.* To the extreme limit of Sind. (Habb River). *Bengal. Himalayas.* Dehra Dun to Sikkim. *Assam. Burma. Siam. S. China and Coastal Islands. Malay Peninsula* ? *Malay Archipelago* ? Java.

Note.—Flower questions the Malay Peninsula. Pythons are in the stock in trade of every Indian juggler, and some of these men travel beyond India. Pythons are transported occasionally in cargoes and it is not so long ago that a *reticulatus* reached the London docks, and was sent to Regent's Park. (The Field, 31-8-07). Another ***reticulatus*** was found on board ship at Bombay among a cargo of timber shipped from Moulmein. These facts may explain the occurrence of other snakes in unexpected localities.

22. (285) **Python reticulatus** (Schneider.) *The Reticulate Python.*

Annandale, J. A. S., Beng., 1905, *p* 175; *Boulenger, Cat. Vol I*, 1893, *p* 85; *Hagenbeck, Spol. Zeylan* 1905, *p* 197; *Bomb. N. H. J. Vol XVI, p* 505; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 4.

Distn.—Burma. Moulmein. (Bombay colln.) Pegu Yomas, 15 miles from Minhla. Martaban. Tavoy. (F.W.) Mergui. (Ind. Mus.) *Nicobar Islands. Siam. Indo-China. South China. Malay Peninsula. Malay Archipelago.* Sumatra to Timor. *Pacific Islands.* Ceram. Philippines.

Sub-family.—BOINÆ

Genus.—Eryx Daudin.

23. (287) **Eryx conicus** (Schneider.) *Schneider's Earth Boa.*

Gongylophis conicus. *Boulenger, Faun. Brit. Ind. Rept.* 1890, *p* 247 ; *Ferguson, Bomb. N. H. J. Vol XIV, p* 386; *Millard, Bomb. N. H. J. Vol XV, p* 348; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 5.

Eryx conicus. *Boulenger, Cat. Vol I*, 1893, *p* 124 ; *D'Abreu, Bomb N. H. J. Vol XXIV, p* 9; *Gharpurey, Bomb. N. H. J. Vol XXIII, p* 372; *Levett-Yeats, Bomb. N. H. J. Vol XXIII, p* 371; *Pitman, Bomb. N. H. J. Vol XXII, p* 633 ; *Powell, Bomb. N. H. J. Vol XXIII, p* 371 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 143 ; *Trench, N. H. J. Vol XXV, p* 151 ; *Wall. Bomb. N. H. J. Vol XVI, p* 292 ; *l. c. Vol XXI, p* 2.

Length.—838 mm. (2 feet, 9 inches).

Lepid.—The costals, two head-lengths behind the head are 37 to 46, at midbody 40 to 55 ; two heads-lengths before the vent 24 to 35. Ventrals. 162 to 196. Subcaudals. 16 to 24.

Distn.—Peninsular India. South of the Himalayas. *Baluchistan.* Fort Munro. (Bombay colln.) *Sind.* Larkana. (Bombay colln.) *Ganges Valley.* Allahabad. Palair. Boxar, Naini Tal Dist. (Ind. Mus.) Behar. (D'Abreu.) *Lower Bengal.* Singbhum. Manbhum. Chaibasa. (Ind. Mus.) *Ceylon ?* Trincomalee.' ? (Bombay colln.)

Note.—This and the next are frequently to be seen among the stock in trade of jugglers, many of whom travel vast distances. Deception is the very essence of their craft, and no credence whatever should be given to information derived from such a source, these men being notoriously mendacious as I have repeatedly proved. Hence the query to Trincomalee. See also note to *Hurria rhynchops* and *Python molurus.*

24. (288) **Eryx jaculus** (Linné). *Linné's Earth Boa.*

E. jaculus. *Wall, Bomb. N. H. J. Vol XIX, p* 1000.

E. johni. *Boulenger, Cat. Vol I*, 1893, *p* 127 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 143; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 6; *Wall, Bomb. N. H. J. Vol XVI, p* 387 ; *l. c. Vol XX, p* 1034 ; *l. c. Vol XXI, p* 12.

Length.—1,105 mm. (3 feet, 7½ inches).

Lepid.—The costals, two heads-lengths behind the head are 46 to 54, at midbody 47 to 65, and two heads-lengths before the vent 34 to 46. Ventrals. 189 to 213. Subcaudles. 18 to 37.

Distn.—Peninsular India. South of the Himalayas. *Baluchistan.* Hanna. Duki. (Quetta Mus.) *Sind.* Karachi. (Ind. Mus.) Larkana. (Bombay colln.). *Punjab.* Rajanpur. Pind Dadun Khan. (Ind. Mus.) Multan. Jullunder. Delhi. (Bombay colln.) Jhelum. (F. W.) *N. W. P.* Agra. (Ind. Mus.) *U. P.* Lucknow. (Bombay colln.).

In the Journal (Vol. XXIX, p. 127) Ingoldby shows good reason to consider *johni* specifically the same as *jaculus*. His view is supported by Miss Procter and I am in full agreement with these authorities.

Family.—ILYSIIDÆ.

Genus.—CYLINDROPHIS Wagler.

25 (289) **Cylindrophis rufus** (Laurenti.) *Laurenti's Earth Snake.*

C. rufus. *Boulenger, Cat. Vol I,* 1893, *p* 135; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 6; *Wall and Evans, Bomb. N H. J. Vol XIII, pp* 345 *and* 615.

Lepid.—Ventrals. 185 to 245.

Distn.—*Burma.* North to Wuntho and Bhamo. (Long. 96°. Lat. 24°). N. Shan States. (Lashio. Bombay colln.) S. Shan States. (Ava. Ind. Mus. Pyawbwe. Taunggyi. Bombay colln.) Tenasserim. *Malay Peninsula. Siam. Indo-China. Malay Archipelago.* Sumatra to Celebes.

26. (290) **Cylindrophis maculatus** (Linné). *Linné's Earth Snake.*

C. maculatus. *Abercromby, Spol. Zeylan.* 1913, *p* 146; *Boulenger, Cat. Vol I,* 1893, *p* 136; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 127; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 7; *Wall, Bomb. N. H. J. Vol XXVI, p* 863; *Spol. Zeylan.* 1920, *p* 313; *l. c.* 1921, *p* 396; *Oph. Tap.* 1921, *p* 18.

Length.—622 mm. (2 feet and ½ an inch).

Lepid.—Ventrals. 180 to 215.

Dist.—*Ceylon.* Low country and up to about 1,700 feet.

Family.—UROPELTIDÆ.

Genus.—UROPELTIS Cuvier.

27. (291) **Uropeltis grandis** Kelaart. *Kelaart's Earth Snake.*

U. grandis. *Boulenger, Cat. Vol I,* 1893, *p* 139; *Green, Spol. Zeylan.* 1906, *p* 220; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 127; *Wall, Oph. Tap.* 1921, *p* 26.

Distn.—*Ceylon.* At low elevations. Trincomalee. Matara. Kolonne Korle. Badulla.

Genus.—RHINOPHIS Hemprich.

28. (*Nil.*) **Rhinophis fergusonianus** Boulenger. *Ferguson's Earth Snake.*

Boulenger, Bomb. N. H. J. Vol X, p 236; *Cat. Vol. III,* 1896, *p* 596; *Ferguson, Bomb. N. H. J. Vol X, p* 70; *Sarasin, Zool. Jahr. Jena* 1910, *p* 137.

Type.—In the British Museum from the Cardamom Hills.

Length.—320 mm. (12⅝ inches.)

Lepid.—Costals. In 15 rows at midbody. Ventrals. 188. Subcaudals. 4.

Distn.—*Western Ghats.* Cardamom Hills. Near Trivandrum (Ferguson).

29. (296) **Rhinophis sanguineus** Beddome. *Beddome's Earth Snake.*
Boulenger, Cat. Vol I 1893, *p* 143 ; *Ferguson, Bomb. N. H. J. Vol. X, p* 70 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137 ; *Sclater List. Sn. Ind. Mus.* 1891, *p* 7 ; *Wall, Bomb. N. H. J. Vol XXVI, p* 557.
Length.—407 mm. (16 inches).
Lepid.—Ventrals. 182 to 218. Subcaudals. 5 to 11.
Distn.—*Western Ghats.* Mysore (Koppa. Ind. Mus. Kalsa. F. W.) Wynad. Nilgiris. Travancore. Tinnevelly.

30. (293) **Rhinophis punctatus** Müller. *Muller's Earth Snake.*
R. punctatus. *Boulenger, Cat. Vol I,* 1890, *p* 141 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 127 ; *Wall, Oph. Tap.* 1921, *p* 33.
Distn.—*Ceylon.* Hills in the Central Provinces. Kandy. Peradeniya.

31. (294) **Rhinophis planiceps** (Peters.) *Peters's Earth Snake.*
R. planiceps. *Boulenger, Cat. Vol I,* 1890, *p* 141 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 127 ; *Wall, Oph. Tap.* 1921, *p* 36.
Lepid.—Ventrals. 153 to 182.
Distn.—*Ceylon.* Hills in the Central and Sabaragamuwa Provinces.

32. (295) **Rhinophis trevelyanus** (Kelaart). *Trevelyan's Earth Snake.*
R. oxyrhynchus. *Sclater, List. Sn. Ind. Mus.* 1891, *p* 7. (*Nos* 6993, 6978, 6980 to 6983).
R. trevelyanus. *Boulenger, Cat. Vol I,* 1890, *p* 142 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 127 ; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 7. (*Nos* 6941, 6984 to 6986, 6988 to 6990, 8388). *Wall, Spol. Zeylan.* 1921, *p* 405 ; *Oph. Tap.* 1921, *p* 38.
Lepid.—Ventrals. 175 to 204. Subcaudals. 2 to 6.
Distn.—*Ceylon.* Hills in the Central, Uva, and Sabaragamuwa Provinces.
Note.—No. 6987 of Sclater's list was not in the Indian Museum when I examined the specimens.

33. (*Nil.*) **Rhinophis travancoricus** Boulenger. *Boulenger's Earth Snake.*
Boulenger, Cat. Vol I, 1893, *p* 143 ; *Cat. Vol III,* 1896, *p* 596 ; *Ferguson, Bomb. N. H. J. Vol X, p* 70 ; *Sarasin, Zool. Jahr. Jena,* 1910, *p* 137.
Lepid.—Ventrals. 132 to 146. Subcaudals. 5 to 7.
Distn.—*Western India.* South of Ernakulam. (Lat. 10°. Ind. Mus.) From sea level to about 4,000 feet. Pirmed.

34. (*Nil.*) **Rhinophis porrectus** Wall. *Willey's Earth Snake.*
Rhinophis punctatus. *Willey, Spol. Zeylan.* 1903, *p* 88.
Rhinophis porrectus. *Wall, Oph. Tap.* 1921, *p* 35.
Type.—In the British Museum. From near Chilaw.
Length—355 mm. (14 inches).
Lepid.—Costals. In 17 rows at midbody. Ventrals, 281. Subcaudals. 6.
Distn.—*Ceylon.* N. W. Provinces. (Between Chilaw and Puttalam.)

35. (297) **Rhinophis blythi** Kelaart. *Blyth's Earth Snake.*
Boulenger, Cat. Vol I, p 144 ; *Fletcher, Spol. Zeylan.* 1908, *p* 98 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 127 ; *Sclater, List Sn. Ind. Mus.* 1891, *p* 7 (*part Nos* 6955 *and* 6992) *Wall, Oph. Tap.* 1921, *p* 40.
Lepid.—Ventrals. 145 to 168. Subcaudals. 3 to 9.
Distn.—*Ceylon.* Hills in the Central and Uva Provinces.
Note.—No. 6979 of Sclater's list was missing when I examined the Uropelts in the Indian Museum.

36. (*Nil.*) **Rhinophis drummondhayi** Wall. *Drummond-Hay's Earth Snake,*

Rhinophis blythi. *Sclater, List. Sn. Ind. Mus.* 1891, *p* 7 (*part, No.* 6945).

Rhinophis drummondhayi. *Wall, Oph. Tap.* 1921, *p* 43.

Types.—In the British Museum. Co-types in the Indian, Bombay, and Colombo Museums, all from Uva Patnas.

Length.—330 mm. (13 inches).

Lepid.—Costals. In 17 rows at midbody. Ventrals 173 to 191. Subcaudals 4 to 8.

Distn.—*Ceylon.* Hills of Central and Uva Provinces.

37. (292) **Rhinophis oxyrhynchus** (Schneider.) *Schneider's Earth Snake.*

R. oxyrhynchus. *Boulenger, Cat. Vol I,* 1890, *p* 141 ; *Cat. Vol III,* 1896, *p* 596 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 127 ; *Wall Spol. Zeylan.* 1921, *p* 397 ; *Oph. Tap.* 1921, *p* 32.

Length.—571 mm. (1 foot, 10½ inches).

Lepid.—Ventrals. 211 to 227.

Distn.—*Ceylon.* The low country in the Northern Provinces Mullaitivu. Vavoniya.

Genus—SILYBURA Gray.

38. (319) **Silybura macrolepis** Peters. *The Large-scaled Earth Snake.*

Boulenger, Cat. Vol I, 1893, *p* 159 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137 ; *Wall, Bomb. N. H. J. Vol. XIX, p* 756.

Length.—323 mm. (12¾ inches).

Lepid.—Ventrals, 127 to 140 ; Subcaudals, 7 to 12.

Distn.—*Western Ghats.* Between Lonavli (Lat. 18·7°) and Igatpuri (Lat. 19·7°). As low as about 1,500 feet.

39. (298) **Silybura melanogaster** (Gray.) *The Ceylon Earth Snake.*

Boulenger, Cat. Vol I, 1893, *p* 146 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 127 ; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 7 ; *Wall, Oph. Tap.* 1921, *p* 29.

Distn.—*Ceylon.* Hills of Central Provinces.

40. (299) **Silybura pulneyensis** (Beddome.) *The Palni Earth Snake.*

Boulenger, Cat. Vol I, 1893, *p* 147 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137 ; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 7.

Distn.—*Western Ghats.* Palnis. Travancore.

41. (301) **Silybura petersi** Beddome. *Peters's Earth Snake.*

Boulenger, Cat. Vol I, 1893, *p* 148 ; *Sarasin. Zool. Jahr.* 1910, *p* 137 ; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 8.

Distn.—*Western Ghats.* Anamalais.

42. (302) **Silybura maculata** Beddome. *The Large-spotted Earth Snake.*

Boulenger, Cat. Vol I, 1893, *p* 149 ; *Ferguson, Bomb. N. H. J. Vol X, p* 70 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137 ; *Sclater, List. Sn. Ind. Mus.* 1891, *p.* 8.

Distn.—*Western Ghats.* Anamalais. Travancore.

43. (303) **Silybura liura** Günther. *The Dark-bordered Earth Snake.*

Boulenger, Cat. Vol I, 1893, *p* 149 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137.

Distn.—*Western Ghats.* Madura and Tinnevelly Districts.

44. (304) **Silybura ocellata** Beddome. *The Ocellated Earth Snake.*

Silybura ocellata *Boulenger, Cat. Vol I,* 1893, *p* 150; *Ferguson, Bomb. N. H. J. Vol X, p* 70; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137; *Sclator, List. Sn. Ind. Mus.* 1891, *p* 8 (*part,* Nos 4308, 4309, 4310, 6959, 12411, 12414, 12415); *Wall, Bomb. N. H. J. Vol XXV, p* 632; *l.c. Vol XXVI, p* 557.

Lepid.—Costals. Rarely in 19 rows in midbody. Ventrals 185 to 234.

Distn.—Western Ghats. South of the Goa gap. Wynad. Nilgiris. Cochin. Anamalais. Palnis. Travancore. Tinnevelly.

45. (306) **Silybura nitida** Beddome. *The Black-backed Earth Snake.*

Boulenger, Cat. Vol I, 1893, *p* 151; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 8.

Distn.—Western Ghats. Anamalais (Cochin side).

46. (307) **Silybura dindigalensis** Beddome. *The Pale-bordered Earth Snake.*

Boulenger, Cat. Vol I, 1893, *p* 152; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 9.

Lepid.—Ventrals 155 to 168.

Distn.—Hills of S. India. Sirumalais. (Near Dindigul.)

47. (309) **Silybura macrorhynchus** Beddome. *The Long-snouted Earth Snake.*

Boulenger, Cat. Vol I, 1893. *p* 153; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137.

Distn.—Western Ghats. Anamalais.

48. (310) **Silybura beddomei** Günther. *Beddome's Earth Snake.*

Boulenger, Cat. Vol I, 1893, *p* 153; *Sarasin. Zool. Jahr. Jena.* 1910, *p* 137.

Distn.—Western Ghats. Anamalais.

49. (311) **Silybura ellioti** Gray. *Elliot's Earth Snake.*

Silybura ocellata. *Sclater, List. Sn. Ind. Mus.* 1891. (*part No* 12419).

S. ellioti. *Boulenger Cat. Vol I,* 1893, *p* 154; *Cat. Vol III,* 1896, *p* 596; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 9.

Lepid.—Ventrals. 144 to 176. Subcaudals. 5 to 11.

Distn.—Hills of Peninsular India. Western Ghats. South of the Goa gap. (N. Canara. Mysore. Eastern Ghats of Coimbatore District. Nilgiris. Balarangams. Anamalais. Palnis. Tinnevelly.) Shevaroys. S. Arcot. Jalarpet. (F. W.) Golconda. Vizagapatam. Ganjam.

Note.—A specimen (No 144) in the Bombay Collection is labelled Nasik. I think it better to await confirmation of this single locality North of the Goa gap. (See note to *S. phipsoni.*)

50. (312) **Silybura phipsoni** Mason. *Phipson's Earth Snake.*

Boulenger, Cat. Vol I, 1893, *p* 155; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137.

Lepid.—Ventrals. 138 to 157.

Distn.—Western Peninsular India. North of Palghat above about 2,000 feet. Thana. Satara. Belgaum. Dharwar. N. Kanara. Mysore. Nilgiris. Balarangams.

Note.—I found 34 specimens in the Bombay collection mostly without records of locality. One from Paralai, Anamalais (No 50-7) recorded as presented by me is a mistake. Though I have had many snakes from this locality I have not had this species. This mistake justifies the questioning of locality in some other cases. (See note to *Psammophis leithi.*)

51. (313) **Silybura rubrolineata** Günther. *The Red-flanked Earth Snake.*

Silybura brevis. *Sclater, List. Sn. Ind. Mus.* 1891, *p* 9. (*part, No* 6954.)
S. rubrolineata. *Boulenger, Cat. Vol I,* 1893, *p* 155 ; *Ferguson, Bomb. N. H. J. Vol X, p* 70 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 9.
Distn.—Western Ghats. South of the Palghat gap. Anamalais. Travancore.

52. (314) **Silybura myhendræ** Boulenger. *Boulenger's Earth Snake.*

Annandale, J. A. S., Beng., 1904, *p* 208 ; *Boulenger, Cat. Vol I,* 1893, *p* 156 ; *l.c. Vol III,* 1896, *p* 596 ; *Ferguson, Bomb. N. H. J.* 1895, *p* 70 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137.
Length.—380 mm. (15 inches).
Lepid.—Ventrals. 139 to 156. Subcaudals. 6 to 8.
Distn.—Western Ghats. South of the Goa gap. Nilgiris. (Brit. Mus.) Travancore.

53. (315) **Silybura madurensis** Beddome. *The Orange-bellied Earth Snake.*

Annandale, J. A. S., Beng., 1904, *p* 208 ; *Boulenger, Cat. Vol I,* 1893, *p* 156 ; *l. c. Vol III,* 1896, *p* 596. *Ferguson, Bomb. N. H. J. Vol X, p* 70 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137.
Length.—343 mm. (13½ inches).
Lepid.—Ventrals. 140 to 151.
Distn.—Western India. South of Palghat. From sea level (Alleppey to about 5,000 feet in the Travancore Hills.

54. (316) **Silybura rubromaculata** Beddome. *The Red-spotted Earth Snake.*

Boulenger, Cat. Vol I, 1893, *p* 157; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137 ; *Sclater. List. Sn. Ind. Mus.* 1891, *p* 9.
Lepid.—Subcaudals. 7 to 10.
Distn.—Western Ghats. South of the Goa gap. Mysore (Koppa. Ind. Mus.) Anamalais.

55. (317) **Silybura arcticeps** Günther. *Gunther's Earth Snake.*

Boulenger, Cat. Vol I, 1893, *p* 157 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137.
Distn.—Western Ghats. South of the Palghat gap. Tinnevelly.

56. (318) **Silybura brevis** (Günther). *Cuvier's Earth Snake.*

Boulenger, Cat. Vol I, 1893, *p* 158 ; *l.c. Vol III,* 1896, *p* 596 ; *Ferguson, Bomb. N. H. J. Vol X, p* 70 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137 ; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 9 (*part. All except No* 6954). *Wall Bomb. N. H. J. Vol XXVI, p* 558.
Lepid.—Ventrals. 119 to 146.
Distn.—Hills of Peninsular India. Western Ghats. (From Castle Rock to Travancore.) Shevaroys. Ganjam.

57. (300) **Silybura grandis** (Beddome). *The Anamalai Earth Snake.*
Boulenger, Cat. Vol I, 1893, *p* 148 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137 ; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 8.
Distn.—Western Ghats. Anamalais.

58. (305) **Silybura nigra** Beddome. *The Black-bellied Earth Snake.*
Silybura ocellata. *Sclater, List. Sn. Ind. Mus.* 1891, *p* 8. (*part,* No 12413.)
S. nigra. *Boulenger, Cat. Vol I,* 1893, *p* 151 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137 ; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 8 (*part, excepting Nos* 12413 *and* 12419).
Lepid.—Ventrals. 169 to 183.
Distn.—Western Ghats. South of Palghat gap. Anamalais. Palnis Travancore. Tinnevelly.

59. (308) **Silybura broughami** Beddome. *Brougham's Earth Snake.*
Boulenger, Cat. Vol I, 1893, *p* 152 ; *Sarasin, Zool. Jahr. Jena.* 1910 *p* 137.
Lepid.—Ventrals. 195 to 230.
Distn.—Hills of S. India. Palnis. Sirumalais.

Genus.—PSEUDOPLECTRURUS Boulenger.

60. (320) **Pseudoplectrurus canaricus** (Beddome). *The Canarese Earth Snake.*
Boulenger, Cat. Vol I, 1893, *p* 160 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137.
Lepid.—Ventrals. 172 to 189.
Distn.—Western Ghats. South Kanara. Mysore. (Brit. Mus.)

Genus.—BRACHYOPHIDIUM *Wall.*

61. (*Nil.*) **Brachyophidium rhodogaster** Wall. *Wall's Earth Snake.*
Wall, Bomb. N. H. J. Vol XXVIII, p 41.
Type.—In the British Museum.
Length.—178 mm. (7 inches).
Lepid.—Costals. In 15 rows in midbody. Ventrals. 137 to 145. Subcaudals. 6 to 11.
Distn.—Western Ghats. Palnis.

Genus.—PLECTRURUS Dumeril and Bibron.

62. (321, 322) **Plectrurus perroteti** Dumeril and Bibron. *Perrotet's Spinetail.*
P. davisoni. *Boulenger, Cat. Vol I,* 1893, *p* 161 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137.
P. perroteti. *Boulenger, Cat. Vol I,* 1893, *p* 161 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137 ; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 9 ; *Wall, Bomb. N. H. J. Vol XXVI, p* 558.
Length.—420 mm. (16½ inches).
Lepid.—Ventrals. 152 to 181. Subcaudals. 6 to 12.
Distn.—Western Ghats. Nilgiris. Anamalais.

63. (323) **Plectrurus guentheri** Beddome. *Gunther's Spinetail.*
Boulenger, Cat. Vol I, 1893, *p* 162 ; *Sarasin, Zool. Jahr. Jena.* 1920, *p* 137.
Distn.—Western Ghats. Nilgiris.

64. (324) **Plectrurus aureus** Beddome. *Beddome's Spinetail.*

Boulenger, Cat. Vol I, 1893, *p* 162 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137.

Distn.—Western Ghats. Wynad.

Genus.—MELANOPHIDIUM Günther.

65. (325) **Melanophidium wynadense** (Beddome). *The Black Earth Snake.*

Boulenger, Cat. Vol I, 1893, *p* 163 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137 ; *Wall, Bomb. N. H. J. Vol XXVI, p* 560.

Lepid.—Ventrals. 170 to 185.

Distn.—Western Ghats. Coorg. (Bombay colln.) Wynad.

66. (326) **Melanophidium punctatum** Beddome. *The White-bordered Earth Snake.*

Annandale, J. A. S., Beng., 1904, *p* 208 ; *Boulenger. Cat. Vol I,* 1893, *p* 164, *Ferguson, Bomb. N. H. J. Vol X, p* 70 ; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137 ; *Wall, Bomb. N. H. J. Vol XXIII, p* 377.

Length.—590 mm. (1 foot, 11¼ inches).

Lepid.—Ventrals. 180 to 198. Subcaudals. 11 to 18.

Distn.—Western Ghats. Talevadi, Goa Frontier (Bombay colln.) Anamalais (F. W.). Travancore.

67. (327) **Melanophidium bilineatum** Beddome. *The White-striped Earth Snake.*

Boulenger, Cat. Vol I, 1893, *p* 164; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137.

Distn.—Western Ghats. Wynad.

Genus.—PLATYPLECTRURUS Günther.

68. (328) **Platyplectrurus trilineatus** (Beddome.) *The Three-striped Earth Snake.*

Boulenger, Cat. Vol I, 1893, *p* 165; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137.

Distn.—Western Ghats. Anamalais. Palnis ? Travancore. Madras Hills.

Note.—A specimen in St. Joseph's College, Bangalore, is probably from Shembaganur, several snakes having been received from an affiliated College in that locality.

69. (329) **Platyplectrurus madurensis** Beddome. *The Pied-bellied Earth Snake.*

Boulenger, Cat. Vol I, 1893, *p* 166; *Ferguson, Bomb. N. H. J. Vol XIV, p* 386; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 137; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 10.

Length.— 610 mm. (2 feet).

Lepid.—Ventrals. 158 to 176.

Distn.—Western Ghats. Palnis. Travancore.

70. (330) **Platyplectrurus sanguineus** (Beddome). *The Red-bellied Earth Snake.*

Boulenger, Cat. Vol I, 1893, *p* 166 ; *Ferguson, Bomb. N. H. J. Vol. X. p* 71 ; *Sarasin, Zool. Jahr.* 1910, *p* 137.

Distn.—Western Ghats. Wynad. Anamalais. Travancore.

Family.—XENOPELTIDÆ.

Genus.—XENOPELTIS Reinwardt.

71. (331) **Xenopeltis unicolor** Reinwardt. *The Iridescent Earth Snake.*

Boulenger, Cat. Vol. I, 1893, *p* 168; *Sarasin, Zool. Jahr. Jena.* 1910, *p* 142; *Sclater, List. Sn. Ind. Mus.* 1891, *p* 10; *Wall and Evans, Bomb. N. H. J. Vol. XIII,*? *pp* 352 *and* 620; *Wall, Bomb. N. H. J. Vol. XV, p* 525; *l. c. Vol. XIX, p* 292.

Length.—1,220 mm. (4 feet).

Lepid.—Ventrals. 164 to 193. Subcaudals. 25 to 31.

Distn.—Burma. As far North as Myitkyina and South as Tenasserim. *Malay Peninsula. Siam. Indo-China. Malay Archipelago.* Sumatra to Celebes.

Note.—I discredit the locality of specimen No. 8035 in the Indian Museum recorded as Trichinopoly, and until confirmation of the occurrence of this species in South India is forthcoming, it is better to regard this record as a mistake. If the locality is correct it may be accounted for through the agency of an itinerant snake man.

(*To be continued.*)

THE RED ANT

BY

MAJOR R. W. G. HINGSTON, I.M.S.

PART 1. THE NEST.

(*With two plates and a text figure.*)

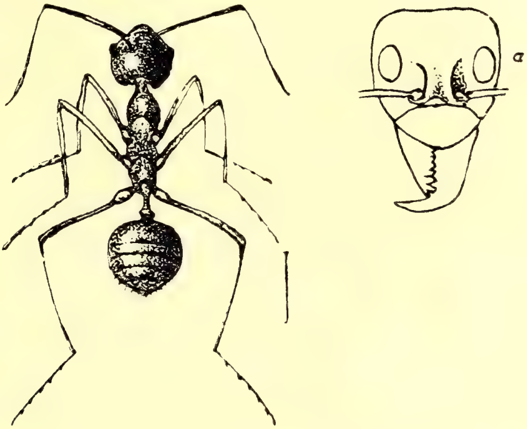
Distribution and haunts—General appearance—Characters of nests and byres—Contents of these chambers—Architecture of Nest—Repair of damaged nest—Characters of seamstress—Construction of byres—Bending of a single leaf—Nature of silk—Attention to nest—Loss of life in nest—Defence of nest—Emission of poison—Contrast with Polyrhachis.

The Red Ant of India, the *Œcophylla smaragdina*, is, with the exception of arid and mountainous tracts, widespread throughout the whole empire. It prefers the moist and well-wooded areas, and is, therefore, more abundant in the southern half of the Peninsula and in the luxuriant vegetation of Ceylon. Eastward it ranges into Burma and Siam ; thence through the islands of the Malay Archipelago even as far as the Continent of Australia. In Southern India it abounds in myriads, so much so that the birds in certain districts have difficulty in finding places of security for their nests. In the drier tract towards the north of the Peninsula there is no such profusion of swarms. Nevertheless they establish themselves in suitable localities, and a few miles from my station there was a mango-grove which they had specially selected as a permanent abode. More than half the trees supported their columns, while studded through the luxuriant foliage above were numbers of their leafy nests. Here they were sufficiently abundant for our purpose. We will spend our evenings in the midst of the grove and take note of their peculiar habits and ways.

The grove is a dense and luxuriant plantation which has stood there for many years. Its large full-grown trees are regularly disposed. They stand in parallel well-ordered lines that intersect like a pattern of squares. Many of them bear evidence of the stress of time. Their boughs are knotted where old branches have decayed, and crumbling hollows have found a place in the substance of their deformed trunks. Overhead a dense mass of foliage expands and, in places the widespread branches intermingle so as to unite the adjacent trees. Beneath this superfluous canopy of leaves is a welcome though enervating shade. The long-waited rains have broken : the fresh green verdure drips with moisture and the air is steamy with the vapid heat. There is a peaceful silence in the grove ; the atmosphere is still, as though confined by the dense trees, and a calm oppression weighs upon the body in the midst of the close moisture-laden air.

The voices of the birds ring out from the trees, though themselves unseen in the richness of the growth. We hear the shrill cries of the noisy parrotquets where a flock has alighted on a mass of vegetation and vanished in the cloud of leaves. From another place we hear the soft cooings of the doves or the brain-fever bird uttering its vexatious cry in a mad crescendo note. From a gnarled trunk comes the tapping of the woodpecker, while in the foliage the coppersmith is beating at its forge in a loud and clanging voice. This is the music of the mango-grove, the living sounds that break the silence and accompany our patient hours of study " under the shade of melancholy boughs."

This ant is so conspicuous on account of its colour, it infests the tree in such enormous numbers and it falls on an intruder with such venom and force that it is not likely to be mistaken by anyone who has ever experienced its furious assault. Its chief haunts are the trunks and the branches of the trees. From there it spreads itself everywhere through the foliage and sends down its columns to explore the ground. A community keeps usually to one tree but, when the grove is young and closely planted, it may spread itself over a number of trees either by climbing across an interlacing branch or by despatching a file over the open ground. In these journeys it often travels a considerable distance; down one branch, up another branch, a column will make the most elaborate excursions throughout the widespread foliage of the tree. It is not a specially active ant. When enraged, it is certainly expeditious enough, but at ordinary times it is often sluggish in its motions, though thoroughly methodical and well organised in its acts. There is no cessation from its continuous labour; night and day its columns are on the move. The heat of the sun does not damp its toil for it is screened by the canopy of leaves; neither does the darkness of night subdue it; indeed after sunset it is specially active, for numbers then pour out from the nest to travel energetically over the tree.



The Red Ant, *Œcophylla smaragdina*
a. Head from front.

Before discussing its peculiar habits I must first describe the appearance of the ant. In colour it is a uniform yellowish red, and is scarcely half an inch in length. Its body is of a particularly elongated shape. It has something the appearance of a knotted cord, being composed of a series of swollen nodules connected by narrow joints. The foremost nodule is the pear-shaped head. It is broad behind where it joins the neck, but in front it evenly narrows to a point which is formed by the projecting jaws. On each side of the middle of the head is the dark conspicuous eye. This is a small and prominent coal-black spot, the only striking point of colour to be seen on the body of the ant. Between them rise the delicate antennae, a pair of slender filiform threads of rather exceptional length. The jaws project from the apex of the pear. In structure they appear as powerful hooks; their opposing surfaces are armed with sharp teeth, and they end in curved and pointed sickles which cross one another in the middle line. Behind the head comes the nodulated chest. It consists of a pair of oval swellings with a constricted part between. It is linked to the head by a narrow neck and joined behind to the front of the abdomen by a thread-like moveable waist. The abdomen, like the head, is a somewhat pear-shaped mass-pointed behind, swollen in front, and supporting here and there upon its surface a scattering of delicate hairs. The legs are particularly long and slender, but are otherwise of the typical appearance and shape.

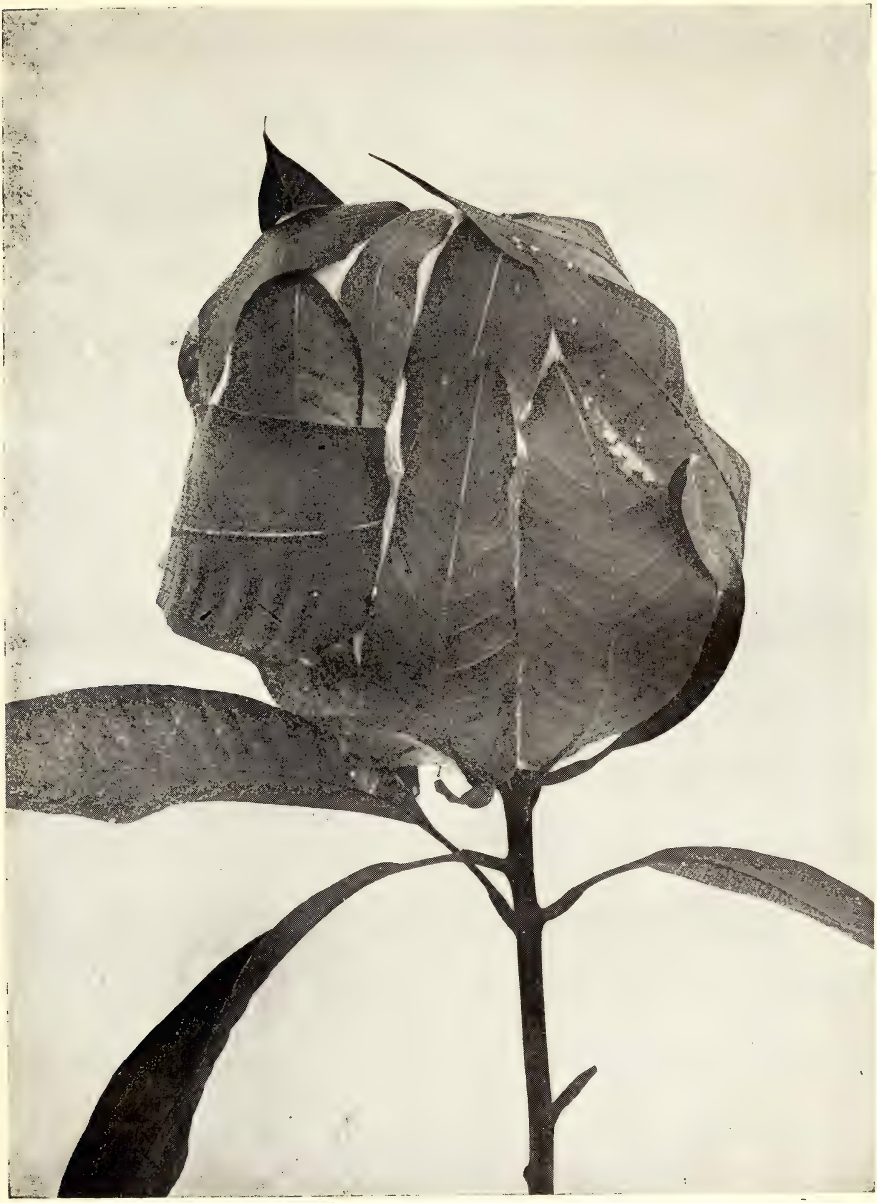
The vast majority of the workers are uniform in size, and at first sight there appears to be no distinction into different types or castes. But in every community there are a few individuals of a specially diminutive size; these are less obtrusive than the ordinary workers since they keep more habitually to the interior of the nests. They are scarcely half the bulk of the ordinary forms but seem to differ in no other way, and they appear to fulfil a special purpose by being retained exclusively for household work.

I will first consider the nests of these ants and the remarkable manner in which they are made. The red ant, unlike the majority of species, never excavates a gallery in the soil. It chooses the foliage as the site for its nest, usually selecting some safe position high up in the thickest leaves. It is wonderfully skilful in its mode of architecture which consists in first bending down the leaves and then uniting their margins with silk. A nest, thus formed, is a bulky object. (See plate). A populous one, when fully constructed, may be as large as a man's head. Some twenty or more leaves may be used in its architecture, but for other nests of less capacious dimensions half that number will suffice. The leaves of the mango are long and narrow, and eight of them bent over so as to lie side by side is common in the smaller nests. In this way, when their edges are linked together, they enclose a pear-shaped space. The base is above at their attachments to the stem; the apex is below where all their tips unite at a common point. The gate of the chamber is very regular in its position. It is always placed at the upper extremity as a perforation in the base of the pear.

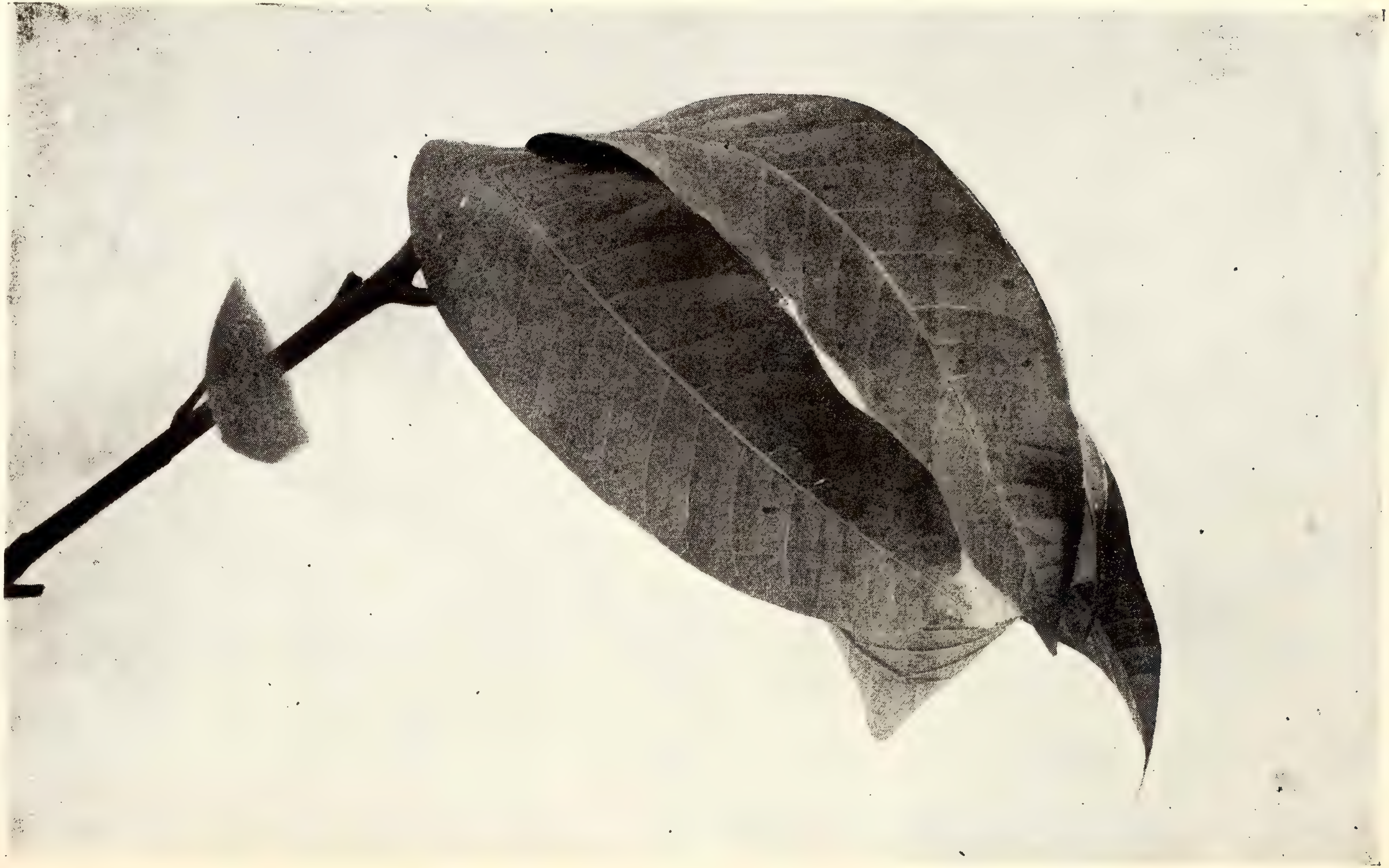
The interior is divided into a number of apartments. They have not been constructed on any system; they are merely the collection of chambers and passages that follow from the shapes and flexures of the leaves. But the ants, in addition, build silken partitions which serve as dividing walls, or they may even so dispose of the fabric as to fashion a complete apartment of silk. They never line the internal wall in the same manner as do the *Polyrhachis* ants; they employ their silk as a connecting medium, merely to unite the edges of the leaves.

In addition to this large and predominant nest, there are also a number of subordinate structures scattered irregularly over the tree. These are likewise fashioned out of leaves though on a very much reduced scale. To all appearances they are just miniature nests, though in reality they are not used for the rearing of larvæ; they rather serve as a system of chambers or byres in which the ants confine those cattle that supply them with a rich and valuable juice. The main nest, as I have said, is usually high in the branches where it looks like a large green globular mass firmly fixed to the tree. The byres, on the other hand, may be situated anywhere; in the young trees they are often conveniently built within easy reach from the ground.

An ordinary byre (see plate II) is usually ovoid or somewhat pyriform in shape. Some three or four leaves may enter its construction. They have been neatly turned as to enclose a chamber, and their lines of union are marked on the exterior by a pattern of silken bands. At one extremity there is a single gate, usually situated where the bases of the leaves come together near their junction with the stem. In some byres only a solitary leaf may be employed, and then the apex is drawn down to the base so as to form a somewhat conical cell. There are times when the ants find considerable difficulty in getting the edges of the leaves to join; wide intervals may then be left between their margins, and the ants must supply the deficiency in material by filling in the spaces with silk. Then again there are places where few leaves are available which results in considerable expenditure for the ants. They must then build the chamber unaided by the vegetation and compose it exclusively of silk. This last type becomes a most delicate tabernacle, one with beautifully fine transparent walls through which we can observe the workers in the interior and learn something of the arrangements and economy of the byre.



NEST OF THE RED ANT (*Œcophylla smaragdina*).



BYRE OF THE RED ANT (*Œcophylla smaragdina*).

This edifice, thus built for the stabling of cattle, is usually a one-chambered cell. But when a number of leaves are employed in its construction, then, like the nest, it may be divided into compartments owing to the enclosure of some of the leaves. Also, on more exceptional occasions, they will come still closer to the elaborate structure of the nest, in that they will weave a special silken partition so as to connect two or more of the walls. Consequently we may regard the architecture of the byre as that of a miniature and less complicated nest.

The ants in their operations so bend the leaves that most of them are sharply doubled near their stems. Nevertheless for a long time they remain uninjured; it is not till they have seen some months of service that they show any signs of decay. While still fresh and green they are in no way conspicuous. A byre just appears like a cluster of leaves and is therefore not easily seen. It is best located through the movements of the ants, by following the advance of a train of workers as they ascend into the smaller branches of the tree.

Let us look into the interior of these remarkable structures and determine the uses to which they are placed. On all occasions there are workers assembled in the nest. Sometimes they appear as a teeming multitude congregated in a solid heap; at other times they spread themselves more evenly through the chambers and move sluggishly over the inside walls. They are mainly engaged in attending on the larvæ, though they also act as an army in reserve to pour from the gateway should necessity require. There is a continuous flow through the aperture of the nest; some are arriving, others departing, there are still others which seem to be permanently imprisoned and never do any outside work. The next most conspicuous objects are the larvæ and the broods of delicate eggs. Every size and age is represented, at least in the suitable months of the year. There are the tiny almost invisible eggs, the oval smooth segmented larvæ, the fragile pupæ, devoid of covering and with all their separate organs distinct. There are some which are bloated to an enormous bulk and look twenty times the ordinary size. These are the larvæ of the future queens of which there may be many in a single nest. The apartments do not serve as separate nurseries either for the occupation of different types of larvæ or for the successive stages of their growth. The young of every kind, of the queens, the males, the ordinary workers of all sizes and all ages, are accumulated indiscriminately in common heaps. The silken partitions which the ants construct often form a soft delicate bag in which a great number of the larvæ are housed. There they may be heaped into a congested mass where no doubt they are most suitably and comfortably lodged within the shelter of so delicate a cell. But they are not kept exclusively in these silken tabernacles; many of them are confined to the ordinary chambers where they lie in contact with the leafy wall.

If we examine the interior during the month of June we are sure to find some of the winged forms inside. The queens are massive ungainly creatures, in colour either a pale brown or a beautiful leafy green. The males are much smaller and darker in appearance, and are often more numerous than the queens. Those insects which serve the ants as cattle are also stabled within. Later I I will describe them in sufficient detail, and will just mention here that they are habitually quartered over the walls and partitions of the nest. A variable and miscellaneous collection of insects may also be scattered throughout many of the rooms. These are the victims which the ants have captured and have carried to the nest for food. There may be beetles and bugs of every kind; when the mango is in bloom we will find many lady birds, a few of them occasionally still alive, but the majority quite dead. At this season too there will be tiny hymenoptera and probably a number of fragile flies, for such is the harvest gathered by the ants from the insects that visit the mango when in flower. Bees and moths are also taken in. Ants of other species are most usual in the cemetery, even the massive soldiers of the ponderous black ant, or more often the powerful *Myrmecocytus* which seems to be one of their most particular prey. Lastly there may be a number of their own dead workers, some of which have probably been dragged in from the exterior, while others are their comrades who have died inside.

The subsidiary chambers that serve the purpose of a byre are much less populated than the main nest. There are always workers in the interior and a variable collection of cattle on the leaves. There is the same miscellaneous accumulation of insects, for the ants will take their captures to either the nests or the byres. Since the byre is not a chamber for the propagation of the ants there as never any mass of larvæ inside. But one or two are usually found in the cavity. It is not their natural and established habitation ; they are visitors retained for their architectural powers, the nature of which I will later describe. Some times a few of the well-formed pupæ may also be taken to the byres. They may be found there in an advanced condition of growth when the limbs and antennæ are perfect and distinct and long after that particular period in their lives when they could be of architectural value to the ants. The leafy prison may occasionally be invaded by one of the sexual forms, but this seems to be merely a kind of casual visit from one which has come down from the main nest.

If necessity demands, a byre may be so used as to fulfil the purpose of a nest. Such improvisation must be required only under special conditions as in so unusual an occurrence as this. I removed a nest from its attachments to the tree. By the next day the leaves had become withered and the ants were very dissatisfied with their home. They moved away to a neighbouring branch ; there they turned down a single leaf so as to fashion the simplest of byres, and into this they transported their belongings which thus served them as a kind of temporary nest.

I pass now to discuss their most interesting feature, the manner in which the workers bend these leaves and unite the margins with silk. First we must notice that the leaves of the mango lend themselves to the purpose of the ants. The leaves are long and are so attached by their bases as to grow in a circle round a central stem. Moreover they also tend to droop and their tips are inclined to turn in. This results in a radiating cluster of narrow infolded leaves, and such a tuft-like formation is of service to the ants, for when the edges of the leaves are drawn together they will naturally enclose a central space. The ants, having selected the special cluster which they intend to shape into a nest, set about drawing the edges together in a remarkably ingenious way. Let us consider first the simplest condition, where the margins of two adjoining leaves lie only a little distance apart. The workers stretch their bodies across the narrow gap. The margin of one leaf they grip with their mandibles, the margin of the other with the tips of their hind legs, and thus they begin by connecting the margins with a number of living links. Now they commence to pull so as to cause the approximation of the leaves. They all lie side by side, all parallel one with the other, like so many disciplined and well-ordered men that apply their efforts to a common task. In this way they range themselves across the narrow gap. They do not haul irregularly, nor is there anything casual or intermittent in their efforts ; they are far too economical to waste their strength or use it in a haphazard way. Like sailors, when they man the yard of a ship, so also do the ants lay themselves across and haul in an even line. The row of mandibles seize hold of one edge, the combined legs take a grip on the opposite edge, and slowly, by the exertion of a steady strain, they brace together the margins of the cleft. As the edges come closer and closer to one another the bodies of the ants become too long for the gap. As a consequence they adjust the position of their legs ; they take a series of purchases further and further back and each time strain in a little more. At last they haul in to the full extent and the fissure is completely closed.

The particularly elongated structure of the ant naturally facilitates this peculiar task. A worker, when stretched to the full extent, measures from its jaws to the tips of its hind legs a distance of nine-sixteenths of an inch. Leaves which are further apart than this cannot, therefore, be drawn together without the employment of some additional aid. The workers cannot stretch across the gap and, as a consequence, they adopt the following method in order to increase the length of their reach. Two workers link themselves together by one taking hold of the other by the waist. In this way they almost double their original length and are able to span the gap. Often the interval is of a varying width, being narrow in one place and broader in another; the ants will then adjust themselves accordingly so that single workers strain where the fissure is narrow and linked individuals where it happens to be broad. Should the distance require a still greater stretch, then three, or even four, of them may join together in order to approximate the furthest leaves. It is thus by the exertion of a steady strain that the ants draw together the margins of the leaves, but they could never effect such wonderful results did they not all combine their individual efforts so as to act as one common team. And if the leaves are beyond their reach, then they have at hand an excellent resource; they join themselves together into a living chain by which they can extend to the most distant parts.

Separate groups of workers may at the same time be employed at different parts of the nest. And the leaves, while in the process of being braced together, are often drawn round so as to envelop other leaves, and these latter will then act as a series of walls which divide the chamber into subsidiary cells.

So much for the drawing together of the margins. I now come to the method by which the workers unite the edges with silk. While the leaves are being held in close apposition and the workers are still in their position of strain, an ant appears with a larva in its jaws which it intends to employ for the generation of the silk. A most remarkable operation now takes place, though it is very similar to what I have described in the case of the *Polyrhachis* which constructs another type of byre. The worker holds the larva by the back about one quarter of its length from the anterior end. The head of the larva thus projects in front while the rest of its body is tucked away beneath the worker's chest. The larva is then lifted from side to side, and is gently applied to the edges of the leaves along the line where their margins touch. Its movements are perfectly regular and precise, they are almost mechanical in their even rhythm. It is an oscillating motion like that of a pendulum; the swings bringing the larva to opposite sides of the junction, and whenever it is made to touch the edge of a leaf it anchors a filament of silk. This remarkable spinster seems to understand what is required; it never neglects to affix its filament, nor does it expend its efforts in needless contortions when it is not thus wonderfully employed. It even seems to co-operate with the wishes of the worker, for at every touch there is a bending of its head, a voluntary effort on its own behalf to emit the slender thread.

The threads are thus spread from side to side, and the leaves are joined by this extraordinary process, the ants making use of their own young to generate the connecting lines. The threads are composed of the most delicate of filaments, being quite invisible to ordinary observation without the aid of a powerful lens. But as the threads increase in number by the leava superimposing layer upon layer, a pearly skein of silk becomes apparent which binds together the edges of the leaves. This type of workmanship is tedious and slow, and it needs many larvæ to produce sufficient silk. The application is made both from within and without. At one time we see the larva manipulated from the interior, then it is transferred to the outside and made to operate in a similar way. Thus are the leaves more firmly united since the line of junction is secured on opposite sides. And all the time that this operation is in progress the workers are maintaining their strain on the leaves. They dare not let go in the early stages; if they did so, then the leaves would spring asunder and tear apart the slender threads. The workers must retain their unremitting tension until the larvæ have manufactured a sufficiency of silk to keep the edges of the leaves in place.

It is truly a remarkable and fascinating sight, and an excellent example of united effort directed to a common end. There is first the line of workers that throw themselves across the gap and close it with a uniform strain; there is second the supporter of the living burden adjusting and controlling the flexible loom; there is lastly the larva, an unconscious seamstress which supplies the machinery for the manufacture of the threads. There can be no more ingenious mode of architecture nor any finer example of the division of labour in all the many and varied operations of ants.

The ants employ a similar mechanism when they wish to repair a damaged nest. Thus it is easy to arrange for the inspection of their operations. It is only necessary to tear apart two adjoining leaves and wait for the workers to restore the breach. After the first mad burst of excitement has subsided, they will range themselves across the artificial rent; one or more larvæ will be brought to the scene, and the operation continued as above described. Even if a jagged and irregular breach is made by a piece being cut out of the leafy wall, this too will be taken in hand until it is satisfactorily secured. But in this case it is a more tedious and difficult procedure and results in a more lavish expenditure of silk. For this is not a matter of just connecting edges which have been accurately drawn into place. There is a permanent loss of leafy tissue and the ants have to replace the deficiency in material by spreading out a sheet of silk. Consequently they can no longer apply the larva in the same even rhythmical way. They anchor the filaments at irregular points, yet so carefully adjusting them in accordance with requirements that in the end they construct a uniform sheet.

Let us glance for a moment at this wonderful seamstress. In appearance it is like a small segmented maggot, white and fleshy, and about one-eighth of an inch in length. It is of a narrow elongated conical shape with its mouth situated at the pointed end from where the filaments of silk escape. The other extremity is blunt and rounded, and the entrails can be seen as a dark patch visible through the transparent skin. When extracted from its worker, it rests absolutely motionless; its pointed extremity is gently hooked, but it makes no effort to emit the silk. Though active enough in its workers' jaws, yet when taken away and placed by itself it is as inert as a dead thing. But its silk-producing mechanism lies latent in it waiting for the gentle pressure of the jaws to set the machinery at work.

The jaws of the ant are well adapted to sustain it; their dentated edges grip it on either side and their terminal sickles, turned in below, serve to support it underneath. They cling to their burden with an unrelenting vigour; nothing will loosen the hold. I sever the worker's body in half, but still the jaws remain fixed around the burden and the front half of the ant tries to carry it along. The worker is particularly careful of its charge. I disturb the nest while operations are in progress; the main body emerges in an angry swarm, but the worker employed with the silk-producing larva hurries away to the safety of the nest. The ants may battle with whatever arrives; the larvæ must be kept secure. I removed the larva from its operating worker and placed it again on the nest. A second worker immediately seized it, but made no attempt to use it for the generation of silk. A third then took it over from the second, and, without any endeavour to make it spin, carried it to the interior of the nest. I repeated the experiment with a somewhat similar result. Thus I conclude that the duty of manipulating the larva is not one that any ant is ready to perform, it is rather the single and particular business of the special worker which has undertaken the task.

The byres are constructed by a similar method to that employed in the architecture of the nest. It is thus unnecessary to describe the usual type in which the leaves are united side by side. But there is one example which deserves more attention, namely the chamber which is fashioned out of a single leaf. This mode of architecture puzzled me much. Though at first sight it appeared extremely simple, being composed of just one single bend, yet I could not understand by what particular mechanism the ants were able to so flex the leaf as to draw down the apex until it touched the base. A leaf of the mango is six or eight inches in length ; it is long and narrow and somewhat oval in shape, being pointed at either end. Now the ants have to double this elongated leaf, to bend it acutely across the middle so as to fold it into half its length. From where do they obtain their points of purchase, for this seemed to be quite a different operation from that of merely closing a gap.

But I found that the ants very easily performed what seemed to me a rather difficult feat. They commenced operations at the apex of the leaf. One of the workers, the most important individual in this strange machinery, first proceeded to the extreme tip. It grasped the point of the leaf in its jaws ; a second worker then took hold of the first worker's waist ; a third fastened itself to the second, and so on until a chain was formed of half a dozen ants which extended from the tip along the mid-rib of the leaf. Then they all began to pull together ; it was a tug-of-war against the rigidity of the leaf, a struggle in which the worker at the tip bore the full force of the strain. But soon the tip began to bend ; this was the most flexible part of the leaf and it slowly gave way before the efforts of the team. As it bent down, the line of workers retired along the leaf so as to enable them to take a purchase further back and thus secure the full benefit of the heave. But though a chain of workers could thus bend the tip, it was insufficient to flex the main body of the leaf. It was necessary now to supplement their efforts in order to advance the work. The necessary assistance was ready at hand waiting for the opportunity to come into use. This opportunity had now arrived, for, as soon as tip was slightly bent, a number of other workers immediately advanced and grasped the margin on either side of the tip Some pulled merely as individuals, others converted themselves into living chains like the one which stretched down along the mid-rib of the leaf. Thus although greater effort was demanded as the flexure increased, yet more and more workers could come into action as the leaf continued to be turned down. In this way the operation rapidly advanced, and the increasing numbers coming in on either side soon overcame the resistance of the leaf. In fifteen minutes they had completely bent the structure so that the two extremities almost touched one another and the apex was in contact with the base. The more familiar operation then immediately followed. The workers aligned themselves along either side ; then, all together and in perfect order, they drew the separated edges into place, and very soon the larvæ arrived in order to finally secure them with silk.

Thus are the ants prepared for all ordinary contingencies. Their simplest plan is to draw leaves together, but if necessity requires they can bend one on itself, and under circumstances more extreme, when no foliage is available, they can fashion their chambers exclusively of silk.

The expenditure of silk in the architecture of these nests must often be very great. This is specially so when the foliage is scanty. I recall one nest as large as a man's head which contained only the thinnest scattering of foliage and looked like a huge white ball upon the tree. The stress of weather too increases their expenditure by necessitating frequent acts of repair. The wind must occasionally wreck their workmanship, for I have seen the leaves torn asunder as a consequence of a heavy gale.

Let us look more minutely at the silken tissue before leaving the architecture of these nests and byres. I examine the fabric on the microscopic stage. I see a vision of marvellous complexity, an infinitely delicate entanglement of lines. Each separate thread is a slender filament, sharp and clear and exquisitely fine. All are interlaced into a sinuous tangle; the threads are bent into gentle curves, they touch one another, adhere to one another, they cross, they intertwine and are all closely and neatly interwoven into a fabric of the finest stuff. But it is the closeness of the texture and the multitude of the filaments which most impress us in this silken layer. They make us realize the tireless labour of the larvæ and give to the mind a more clear perception of the exquisite precision and accuracy of the work.

The ants are naturally very attentive to an edifice which has cost them such labour to build. A number of them always remains on the exterior; these are the guardians, prepared, if necessary, to make an immediate attack. Others, which are entering or leaving the gateway, can also lend their aid. But the main body remains in the interior and pours forth only when specially summoned by those on duty outside.

I placed some sticks and pebbles on the wall of the nest, but the ants would not permit of this intrusion; they quickly took hold of these foreign materials and immediately threw them to the ground. Similar objects which I pushed into the interior were also ejected without delay. Even so nauseous a substance as a nodule of camphor was seized by a pair of valiant workers and with difficulty forced through the gate. In the same way they eject all useless materials which result from the natural economy of the nest. For example, the wings and the indigestible remnants of their captures are methodically thrown out. I placed a worker of the same species, though from another nest, on the outside of one of these byres. In an instant it was seized; one took it by the head, a second by the tip of the abdomen, while the others gripped it all round by the legs, and, though an insect of their own species, yet, being a stranger, it was quickly put to death.

For some reason there is a considerable loss of life in the interior of many of these nests. I have often found the remains of dead workers within, usually a miscellaneous accumulation of their fragments collected in some corner of the wall. In one nest, which I kept suspended over water, I observed that a worker frequently came forth carrying the remains of a comrade in its jaws. One would have a leg, another an abdomen, a third a portion of the head and chest, and these they would drop a little distance from the gateway so that they fell into the water beneath. By evening the water was strewn with fragments, so that for some reason a systematic destruction was occurring in the interior of the leafy nest. It may possibly have been increased by the artificial conditions which resulted from removing the nest from the tree. Nevertheless I have so frequently found dead workers in the interior that it would seem that, as these nests are so rich in eggs displaying such profusion of generative power, so also is there evidence of that strict mortality which this lavish procreation must necessarily demand.

The care which the ants bestow on their habitations is best indicated by their manner of defence. If we climb into the branches so as to approach the nest we will meet a daring and most virulent attack. The foliage becomes suddenly alive with ants, a maddened swarm of ferocious workers pouring from the leafy nest. The sentries on the exterior are the first to be aroused; nothing can approach without alarming them, and they call out the swarm from within. First they erect themselves on their hind legs, their red bodies quivering with anger, their forelegs shaking, their antennæ trembling, they look the embodiment of furious rage. Then they rush forward to make the attack while at the same time the immense army pours out through the narrow gate. They race along the branches that descend from the chamber and, with jaws wide open and poison-glands in readiness, they fall on whoever has disturbed their peace. With bodies erect they throw themselves on the intruder; they come rushing up his legs, climbing in on him from every side, dropping on him from the overhanging foliage, and all the time spreading themselves more thickly about him in a savage and augmenting swarm. In a minute his body is alive with ants, all seeking for his naked skin. Then they attack him with the fiercest determination; they fix their mandibles where they can reach his flesh, penetrating everywhere underneath his clothes in order to bring home the full force of the assault. Wherever they insert their sickle shaped jaws, there they inject their poison into the wound, until the eyes are blinded and the body smarts with the venom of a thousand stings. It is the rapidity and the concentrated fury of the attack which it is so impossible to resist. Moreover each ant is quite reckless in its violence; it clings to the intruder with such a dogged persistency that it will face death rather than separation and can be torn in pieces without releasing its hold.

It is a still more amazing spectacle of fury when a nest is broken in half. Thousands upon thousands of enraged ants then heap themselves into a fiery mass. Their infuriated bodies all shake with rage; they may link themselves together in their angry tumult, and the air for a foot all round is pungent with their acid fumes. This poison they shoot forth in the face of the intruder; it is an intense and caustic fluid, and blinding in its action if it enters the eyes. In the storm of their passion their movements may be audible as they move excitedly over the broken nest. A continuous rustling noise is heard; it is the patter of thousands of tiny feet falling on the leafy wall.

Thus these ants are filled with the offensive spirit and combine in the most reckless and determined manner in order to ensure the safety of their nests. And above all they are invincible because of their self-sacrifice, each ant is ready to fight to the death, utterly careless of its own safety provided it makes for the advantage of the swarm. They certainly can defend their precious habitations from enemies immensely more powerful than themselves. They need fear nothing from reptiles and birds, and any sportsman who has invaded their trees in search of a place in which to wait for game, will be the first to admit that even the largest mammals cannot face the fury of their multitudinous assault. Indeed these ants, by virtue of their self-sacrificing frenzy, hold sovereign rights over their own tree.

The nature of their poison and its mode of emission deserve a few words of note. It is a watery fluid, intensely acid, with a pungent odour, a bitter taste, and burns when it penetrates the skin. These ants do not attack by means of a sting in a manner like bees and wasps. Their plan of operation is far more primitive, yet it serves their purpose well. They can shoot forth their poison by muscular force, sending it for a distance of four inches at least in a sharp and sudden jet. I have had it directed straight into both my eyes when looking from a distance of five inches into a byre. And it was certainly a most effective bombardment for the ants; it resulted in a blinding and a smarting of the eyes which compelled an immediate retreat.

But their more usual manner of employing their poison is after they have secured their hold on the skin. As soon as a worker is thus firmly fixed it proceeds to acidulate the wound. It raises its abdomen, bends it forward over its back until the point lies immediately above its head. Then, in this attitude, it ejects its poison, shooting it as a jet from the tip of its abdomen and directing it forward with such excellent precision that it falls immediately in front of the head. From there it flows in between the jaws, percolating into the wounds that they have made and thus entering the tissues of the skin.

There are other ants of the *Camponotus* group which similarly effect the introduction of the poison through the wounds made by their jaws. But they conduct the operation in a somewhat different way. The Indian Black ant, for example, curls its abdomen under its chest and thus advances the tip until it almost touches the wound. I have sometimes seen the red ant adopt this method and bend its abdomen far underneath it before expelling the juice; but such does not appear so efficient a mechanism, and it almost invariably adopts the more remarkable process of shooting its venom over its head. The narrow and constricted structure of the ant facilitates this peculiar act, and no doubt for this purpose its abdomen is hinged to its thorax by a particularly elongated waist. Indeed this attitude of abdominal erection is a very characteristic one for the ants to assume. They frequently do so when alarmed or enraged even though not actually ejecting poison at the time. Such also is the attitude in which they become fixed if they are allowed quietly to die. The abdomen remains elevated rigidly at right angles. This seems to be the natural position of adjustment when all vital strain is removed, and thus the attitude of battle so furiously fought is preserved in the posture of death.

I think that the poison is sometimes peacefully ejected so as to accumulate in the interior of the byres. I have found large drops of it attached to the walls which suggests that the ants possess an abundant supply. There is not only sufficient for the purpose of defence, but there is also an excess of the poisonous fluid which the workers for some reason, perhaps merely as waste, habitually excrete into their byres.

I will conclude this account of the red ant's nest by comparing it with that of another species which also builds habitations of silk. The *Polyrhachis simplex** constructs nests and byres, placing them on the trees as does the red ant and employing their larvæ in a similar manner for the generation of the silken lines. But there are certain characteristic points of difference in the architectural activities of the two ants. The red ant permanently nests upon the trees; the *Polyrhachis* constructs its main formicary in the ground and uses the branches for the location of its byres; it is only when the soil becomes saturated with moisture that the whole of the community seeks refuge in the trees. The red ant gathers in the surrounding leaves which it shapes into the walls of its nest; the *Polyrhachis* carries up extraneous materials, twigs and seeds and anything convenient, which it uses as bricks to build into the wall. The nest of the red ant is a green pendulous structure, bulky and capacious, and of a globular shape; that of the *Polyrhachis* is usually wrapped around a stem, looks like a collection of withered fragments, and is often in the shape of a narrow elongated tube. There is a special point of difference with respect to the silk. The red ant employs it as a connecting medium with which to secure the edges of the leaves; the *Polyrhachis* inter-weaves it amongst the bricks of the structure and also extends it as an even layer that lines the whole of the interior of the nest.

(*To be continued.*)

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* The operations of the *Polyrhachis* are fully discussed in "A Naturalist in Hindustan."

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY.

No. XLII.

THE DISTRIBUTION AND GEOGRAPHICAL RACES OF THE GULANDI BUSH RATS. (*GOLUNDA ELLIOTI*).

By Oldfield Thomas, F. R. S.

(By permission of the Trustees of the British Museum.)

During the course of the Mammal Survey a very considerable number of specimens of the Gulandi have been obtained from all parts of its comparatively wide range, so that in making a study of its local distribution and the geographical races into which it has been modified, I have had for consideration something over 180 specimens, from about a score of selected localities. We have thus got a very fair idea of its range and modifications, and may make an attempt to classify and record them. There is however one flaw in the composition of the series, a flaw very usual in the Survey collections, and indeed inherent in the means by which it has been brought together. No single locality is represented by specimens of two or more seasons, the Society's collectors not returning to a locality after a first collection has been made there. In consequence we are largely ignorant of the seasonal changes of the various animals, and I would urge members of the Society who may have the opportunity, to help us by obtaining specimens in any locality they may be living in at several seasons of the year, so that we may learn something of the seasonal changes. This request applies to all Mammals, not only to *Golunda*, and if complied with, would greatly help work on the Survey collections.

It would appear certain that all the forms now dealt with should be considered as belonging to a single species, for they all appear to intergrade, and no tangible or permanent skull differences are observable. The skulls, it is true, show a considerable range of variation both in general size and in the size of the bullæ, but these variations appear commonly to be independent of locality, and the only character that I can find to classify the races is coloration, in which, as might be expected among animals inhabiting so large and diversified an area, there is a very considerable degree of difference.

The whole range of *G. ellioti* covers almost precisely the area which used to be known as "Hither India," extending from the North-West Frontier at Kohat southward to Madura and Ceylon, and eastward to the Bhotan Duars. No specimens however have as yet been recorded along the eastern coast districts of the peninsula from Madras to Calcutta; but this is the least surveyed part of India proper, and they may still prove to occur there.

The following would seem to be the recognisable races of *Golunda*, commencing in the far north-west, but it must be premised that owing to the absence of cranial characters, and the variation that occurs in each series, it is not possible to diagnose the forms with such exactness that they can be always recognised, and the descriptions must be used in conjunction with the localities, and with due allowance for the colour variations.

1. *Golunda ellioti limitaris*, subsp. n.

Nearly uniformly grey, as in the subspecies *watsoni*, the hinder back very slightly more buffy. Hairs, however, longer and much softer than in *watsoni*, with practically no broadened spinous hairs intermixed. Undersurface well covered with soft hairs, which are slaty proximally, white terminally. Orbital rings, nasal spot, and yellow spot at base of ear scarcely perceptible. Feet buffy whitish, the metatarsals browner.

Habitat.—Kohat, N. W. Frontier. Altitude 2,200′.

Type:—Adult male. B. M. No. 6. 10. 11. 3. Original number 21.

Collected 25th February 1906 and presented by Capt. C. H. T. Whitehead. One specimen.

Evidently most nearly related to *watsoni*, but distinguished by its much softer fur.

2. *Golunda ellioti watsoni*, Blanf.

Pelomys watsoni, Blanf. P. As. Soc., Bengal, 1876, p. 181.

Golunda ellioti, id., J. A. S. B., XLV., pt. II., p. 165, 1876.

Fur coarse and harsh, with many spinous hairs mixed with it. In colour like *limitaris*, nearly uniformly grey, or, rarely, with a slight buffy suffusion on the hinder back. Distinct buffy eye-rings, a buffy spot on each side of the nose, and another at the base of the ear. Feet buffy whitish.

Habitat.—Lower Sind and its Western borders. Specimens seen from the Khirthar Range (type), Habb Valley, Sukkur, Khairpur and Larkhana.

Type in British Museum. In spirit; B. M. No. 91. 11. 1. 4.

Collected by Mr. H. E. Watson, and presented by Dr. W. T. Blanford.

3. *Golunda ellioti gujerati*, subsp. n.

Fur stiff and harsh, with many spinous hairs. General colour about the palest of the genus, the fore back pale buffy, the hinder back ochraceous buff. Under surface buffy white, generally, but not always, with some slaty at the base of the hairs. Ochraceous-buffy nose-patches, eye-rings and basal ear-spots all well marked. Hands and feet pale buffy.

Skull, on the average, with the supraorbital ridges more heavily developed than usual.

Dimensions of the type, measured in flesh:—

Head and body 128 mm.; tail 107; hindfoot 24; ear 15.

Condylo-basal length of skull 29·5.

Habitat.—Southern Rajputana, Gujerat, Cutch and Kathiawar.

Specimens seen from Mt. Abu, Rajputana, 4,300′; Palanpur, 150′ (type), and Danta, Gujerat; Charwar, Cutch; Dhrangadhra and Bajana, Kathiawar.

Type:—Adult male. B. M. No. 13. 9. 18. 43. Original number 2943.

Collected 9th April 1913 by C. A. Crump for the Mammal Survey. Fifteen specimens.

The palest form of the genus, as is not unnatural from the climatic conditions. Buffier and not so grey as in *watsoni*. The complete identity of the specimens from high up on Mt. Abu, with those of the lowlands of Gujerat and Kathiawar is very noticeable.

4. *Golunda ellioti paupera*, subsp. n.

Size less than in other races, the hind foot 21-22 mm. as compared with 23-25 in most of the subspecies. Tail shorter—less than 100 mm. in length. General colour about as in *gujerati*, or a little more greyish and less pallid. Undersurface muddy coloured, mixed slaty and buffy, less whitish than in *gujerati*. Nose spots and eye rings present, but no buffy spots perceptible at base of ears. Hands and feet buffy.

Dimensions of the type, measured in flesh:—

Head and body 123mm.; tail 95; hindfoot 21; ear 15.

Skull broken, but another specimen is 15 mm. from the front of the incisors to the back of m. 3.

Habitat.—Ambala, Punjab. Extent of range not known. Type from Handisera, near Ambala. 500′.

Type:—Old male. B. M. No. 9. 4. 6. 20. Original number 271. Collected 18th February 1909 and presented by Col. H. N. Dunn, R.A.M.C. Four specimens examined.

Apparently most nearly allied to *G. e. gujerati*, but distinguished by small size and comparatively short tail.

5. *Golunda ellioti ellioti*, Gray.

Golunda ellioti, Gray, Charles. Mag. N. H., I., p. 586, 1837.

Mus golundi, Ell., Madr. Journ., X., p. 208, 1829.

Mus hirsutus, Ell. t. c. p. 213, 1829.

By far the most widely spread subspecies, and as a consequence with a greater range in colour. In general it is of a greyish olive, darker than in the previous subspecies, lighter than in those that follow. The hinder back decidedly more ochraceous or tawny. Undersurface heavily mixed with slaty. Nose-patches, eye-rings and basal spots to ear generally distinct.

Size medium; the type (lectotype) has an unusually small skull, but a paratype is as usual. Type 27 mm. in condylo-incisive length, paratype 29 mm.

Habitat.—Central area of India, from Gwalior southwards through Khandesh to Dharwar and Mysore, and eastwards to Paresnath, Behar. Specimens seen from Gwalior, Saugor, Paresnath, Hoshangabad, Balaghat, Khandesh, Nimar, Berar, Dharwar and Mysore. Examples from Poona and Satara are rather doubtful, and I am not sure about their relationship to the next subspecies.

Type:—(Lectotype). B. M. No. 38a. Presented by Sir W. Elliot.

6. *Golunda ellioti bombax*, subsp. n.

A dark, strongly coloured, hot country race of *G. ellioti*.

Size rather below the medium. Fur not very spinous. General colour strong heavily lined greyish buffy, becoming more or less tawny on the hinder back. Undersurface buffy or whitish, rather strongly contrasted with the sides, the chest washed with buffy ochraceous. Nose-patches, eye-rings and ear spots ochraceous. Hands and feet rather buffy.

Dimensions of the type, measured in flesh:—

Head and body 116 mm.; tail 97; hind-foot 24; ear 15.

Skull, condylo-incisive length 29.

Habitat—Coast region near Bombay. Type from Andheri, Salsette Island, off Bombay. Other specimens from Ratnagiri, Konkan (W. Lord).

Type:—Adult female. B. M. No. 12. 9. 17. 2. Collected by N. B. Kinnear, 21st January 1909, and presented by the Bombay Natural History Society. Four specimens.

Found along the sea-coast near Bombay. A single Gulandi from Helwak, Satara, is also very like it, and it is possible that a form like this extends over nearly the whole of S. India, as an example from Madura, in rather bleached pelage, is also somewhat similar. But further South Indian material is needed before this question can be settled.

In Coorg, however, there is a large dark local race, as happens with other Coorg animals.

7. *Golunda ellioti coraginis*, subsp. n.

Size comparatively large. Colour very similar to that of *bombax*, but duller brown, the hinder back less tawny. Undersurface more muddy-coloured, with less prominent buffy ends to the hairs, and not so contrasted with the colour of the flanks. Nose patches, eye rings and ear spots dull ochraceous, not conspicuous. Hands and feet ochraceous.

Dimensions of the type, measured in flesh:—

Head and body 137 mm.; tail 112; hind foot 26; ear 16·5. Condylo-basal length of skull 30.

Habitat.—South Coorg. Type from Wotekolli, 2,000′. Another from Virajpet, 3,000′.

Type:—Adult male. B. M. No. 13. 8. 22. 66. Original number 2246. Collected 3rd January 1913 by G. C. Shortridge. Presented by the Bombay Natural History Society.

Distinguished from *bombax* by its larger size, darker colour, and less contrasted undersurface.

8 and 9. *Golunda ellioti coffæa*, Kel. and *newera*, Kel.

Musc offæus and *Golunda newera*, Kelaart, Prodr. Faun. Ceyl., p. 67, 1852.

These two Cinghalese forms are probably subspecifically recognisable, but without further material I cannot define their characters and distribution. A specimen from Paradenia, 1,640′, is referred to *coffæa*, and examples from Pattipola, 6,000′, and Ambavela, 5,000′, both in the Central Provinces, to *newera*. The type of *coffæa* is B. M. No. 52. 5. 9. 30 presented by Dr. Kelaart. That of *newera* has disappeared.

Returning again to N. India, we have along the Himalayan chain a race of Golandis for which the name *myothrix*, Hodgson, should apparently be used. The type is an imperfect skin "got at Kahulia Powa, 6,700′, in the Central region of Nepal," and unfortunately no other Nepalese specimens are available. But among the considerable series from Kangra are several obtained in October which nearly resemble it, and, a similar animal occurring in Kumaon, there can be little doubt that this is the real *G. e. myothrix*. It may be briefly diagnosed as follows:—

10. *Golunda ellioti myothrix*, Hodgs.

Mus myothrix, Hodgs., Ann. Mag. N. H., xv, p. 267, 1845.

Size medium. Fur comparatively long and soft, with very few spines intermixed. Colour in summer varying from greyish to buffy, with the hinder back more or less tawny, undersurface washed with buffy. Nose spots, eye-rings and ear spots ochraceous. Hands and feet buffy. In winter the whole animal is greyer, with less difference between fore and hinder back. Hands and feet whitish.

Habitat.—Himalayan chain from Kangra, N. E. Punjab, through Kumaon to Nepal at altitudes from 2,000′ to 6,700.′ Type from Kahulia Powa, Nepal.

Type:—45.1.8.375. Presented by B. H. Hodgson, Esq. About 40 specimens examined.

Finally in the southern part of Bhutan there occurs a race nearly allied to *myothrix*, but distinguished by its duller colour and shorter pelage.

11. *Golunda ellioti cœnosa*, subsp. n.

Size about as in *myothrix*. Pelage decidedly shorter and crisper. Colour showing less seasonal change, a dull greyish brown with comparatively fine ticking. Summer specimens little more buffy than winter, and all tending to be of duller hue than the corresponding forms of *myothrix*. Undersurface muddy whitish, with but little buffy suffusion. Nose spots, eye-rings and ear spots scarcely perceptible. Hands and feet brownish white.

Dimensions of the type, measured in flesh:—

Head and body 116 mm.; tail 102; hindfoot 26; ear 17. Skull, condylo-incisive length 30.

Habitat.—Bhutan Duars—type from Hasimara, 300′; others from Bharnabhari 600′. One also from Angarakhata, N. Kamrup, 300′.

Type:—Adult male. B. M. No. 16.7.29.75. Original number 1310. Collected 21 Dec. 1915 by N. A. Baptista. Presented by the Bombay Natural History Society. Ten specimens examined.

SCIENTIFIC RESULTS FROM THE MAMMAL SURVEY
No. 43.

ON SOME SQUIRRELS FROM THE MERGUI ARCHIPELAGO.

By Oldfield Thomas, F. R .S.

(*By permission of the Trustees of the British Museum.*)

Mr. Primrose, during his exploration of the Mergui Archipelago, obtained a number of Squirrels belonging to the *Callosciurus epomophorus* group, and ot these I described, in a previous number of the Journal, the form inhabiting Tavoy Island.

He has now sent examples from King's Island, Kissaraing, Sir John Malcolm's Island, Sullivan's Island and Hastings Island, and these I have attempted to determine. In doing this I have had the immense advantage of the loan of a number of paratypes of the forms described from the same Archipelago by Mr. Gerrit Miller, to whose kindness I am indebted for the loan.

It is exceedingly difficult to come to any satisfactory conclusions, as in most cases the differences are at the best only average ones of slight shades of colour not absolutely constant on the respective islands, and still less so on the mainland.

For the time being, therefore, I am compelled to content myself with determining the specimens sent from the above-mentioned islands, and to leave a general revision of the subject to future workers.

All the forms of the different islands are slightly modified races of the continental squirrel to which has been applied the name of *Callosciurus epomophorus davisoni*, with type locality Southern Tenasserim.

To this continental form, *davisoni*, I should refer the specimens from King's Island, while those from Kissaraing and Sir John Malcolm's Island seem not to be separable from *domelicus*, Miller, from Domel Island, just to seaward of Kissaraing. Then the series from Sullivan's Island is of course topotypical of *sullivanus*, Miller, and our specimens are absolutely like the paratypes sent. Of the peculiar small grey animal inhabiting High Island (*altinsularis*) we have no examples, but on the other hand the series from Hastings Island, an islet in the angle between St. Luke's and St. Matthew's Islands, is distinct both from *lucas* and *matthœus*, and seems to represent a new form, which may be called :—

Callosciurus epomophorus hastilis, subsp. n.

General colour above nearly uniform finely grizzled greyish olive, without any warmer tinge across the shoulders. Neck patches present, but not conspicuous. Lateral rufous bands fairly developed, becoming stronger on the groins, and continuous with a more rufous colour of the underside of the base of the tail than usual.

Dimensions of the type:—

Head and body, 235 mm. ; tail 197 ; hindfoot 47 ; ear 21.

Skull, greatest length 56·3 ; condylo-incisive length 51. Upper tooth-series exclusive of p. 310.

Habitat.—Hastings Island, Mergui Archipelago.

Type:—Adult male. B. M. No. 23·4·10·6. Original number 525. Collected 14th March 1922 by C. Primrose, and presented by the Bombay Natural History Society.

This Hastings Island Squirrel differs, on the average, by its more uniformly greyish coloration from all the other forms in the Archipelago, with the exception of *altinsularis*, which is even more strongly grey.

In referring the various Mergui Squirrels (notably *bentincanus, domelicus, sullivanus, lucas* and *matthœus*) to the different forms described, I would not be taken as endorsing their validity as subspecies, for it appears to me that their variability and degree of intergradation are sufficiently great to render it somewhat doubtful how far they are likely to be recognised by future writers, when the subject is revised with still more material. And I certainly should not dignify any of them by the use of binomial names.

None the less Mr. Primrose's series, formed with great pains and skill, is of very great value as forming material that will be permanently available both in Bombay and London for a future study of this puzzling group.

A JOURNEY TO SIAM AND BACK.

BY

MAJOR C. H. STOCKLEY, D.S.O.

PART II.

(*With 2 plates.*)

(*Continued from page* 178 *of this volume.*)

I stayed a couple of nights at Ta'ok, and the first night had a sad misfortune. I developed three rolls of my Ta'ok Plateau photographs; and, attaching them to clips which I tied to a low branch, left them in the stream to wash. I returned an hour later just in time to see a large log float down and carry away the whole lot. It was dark and the water three or four feet deep, so I simply had to resign myself to the loss.

In the morning I had a look round for game, and shot a couple of jungle fowl. There seemed to be a large proportion of cocks to hens, and one small flock was made up of three cocks and two hens. On the way back I shot a Berdmore's Squirrel (*Menetes berdmorei*) for the specimen box. I saw no four-footed game at all.

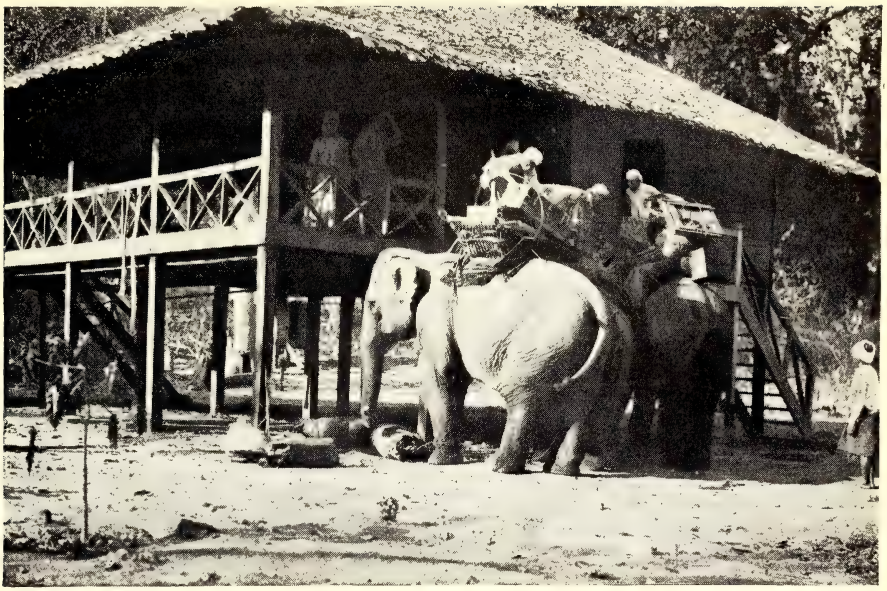
We started off next morning down the valley, passing the junction of the Ta'ok and Megla streams after about two miles, and after fording the Ta'ok twice. The volume of the two streams seemed about equal, but "Megla" supersedes "Ta'ok" as the name of the river from that point until it joins the Gorli eight miles lower down, and the two become the Thaungyin.

The valley, for about five miles, was narrow, with rocky, forest-covered hills on either side, and occasional cliffs forced us to ford five times in the next four miles, and we actually forded the river ten times in the course of the morning. The water was waist-deep in places and the current swift, while the bottom was rough and stony, so I had several involuntary baths before we reached the more open main valley of the Thaungyin and turned from East to North across three miles of flat and undulating country which brought us to Miba, a village on the Thaungyin. There had been little animal life on the march, a gyi and several Berdmore's squirrels being the only mammalia seen, though gibbons (*Hylobates lar*) were heard whooping frequently; and my bearer, Nawash Ali, revealed the fact that he had up to then thought that the noise was made by tigers. Ospreys were screaming peevishly from half a dozen nesting sites in the tallest trees, a few White-breasted Kingfishers furnished a brilliant spot of colour as they flashed over the water, and an occasional jungle fowl made a dash for the undergrowth but there was no sign of the riot of small birds which was so conspicuous a feature of the forest on the west side of the hills. Small fish were plentiful in the river and we passed a Burman and his son who carried over a hundred, up to half a pound, strung on a withy. The absence of side-streams probably accounted for the comparative want of animal life, as the river flowed mainly between two parallel ridges 400 to 600′ high, and the jungle clothing their sides was mostly dry and harsh.

About a mile out of Miba, I was surprised to come on a ridge covered with pines (*Pinus merkusii*), there being about 150 well grown trees.

Miba lies on the bank of the Thaungyin, and there was a forest hut there built on a cliff above the river looking across at the first Siamese village I had seen, by name Thubaw. The Thaungyin forms the frontier between the two countries for the greater part of its length. Thubaw has about a dozen bamboo houses, while Miba seemed little bigger.

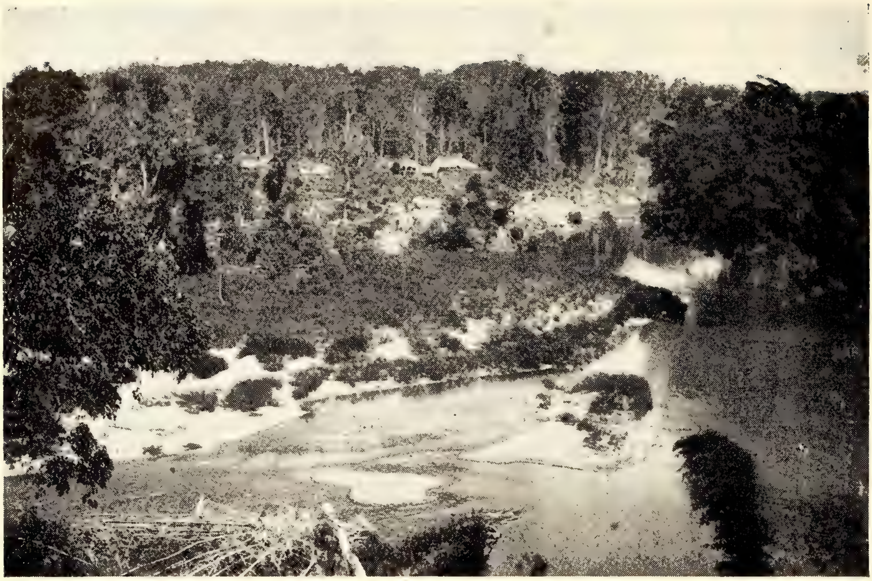
In the forest hut I found G, a young employee of a big timber firm, and their *charge d'affaires* in that region. He was most helpful in getting me supplies



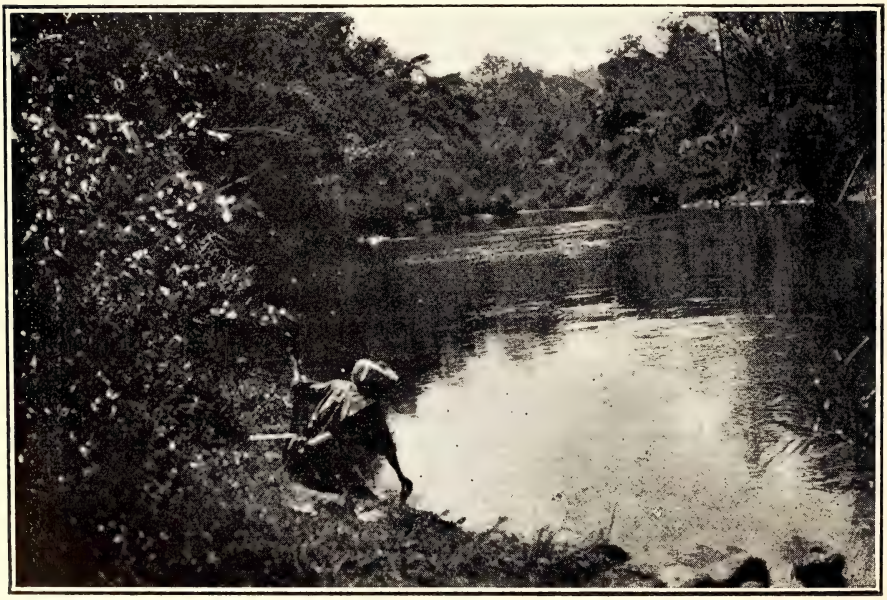
LOADING THE ELEPHANTS WITH KIT.

CROSSING THE SIAM BURMA FRONTIER.

Fording the Thaungyin River.



LOOKING ACROSS THE THAUNGYIN RIVER AT THE FIRST SIAMESE VILLAGE.



THE MELA MOUNG STREAM 5 MILES ABOVE MIBA.

and arranged for us to beat next morning for sambhar, or anything else that might turn up. In the evening I went down to the Thaungyin and fished for a couple of hours without getting a run, although the water looked most promising.

We got off about 7-30 a.m. with some thirty beaters, and accompanied by a Karen contractor of G's, who was armed with an ancient single barrelled gun. We first tried a couple of beats in the foothills, but the only result was a Silver Pheasant hen, which I missed most disgracefully. Then we moved down to the flat ground near the Thaungyin and about three miles above Miba. This looked much more promising to me, and I took up my position, Kunjanaw with me, on the brow of a twenty foot rise, which commanded a flat-bottomed depression in which the thick jungle which mostly filled it gave way to clumps of bamboo just opposite my post. G was a couple of hundred yards away on my right, while the Karen contractor was stationed opposite me on the far side of the depression.

I heard the beat begin, and very shortly afterwards the sound of animals approaching G. Then he fired and a series of crashes announced that the sambhar (as they turned out to be) were coming towards me. Then several more shots from G, two of which nearly bagged Kunjanaw and myself,so we took cover and let the sambhar go by.

Then I heard something coming along the bottom of the depression, and out of some thick scrub burst a black animal travelling at a fast gallop through the bamboos. At first I thought it was a large pig, as he was travelling at such a pace and the action was much easier than the usual ungainly gait of a bear ; then, I realised that it was a rather unusual looking bear and, waiting until he crossed between two clumps of bamboo, let drive at him and was answered by a deep "woof;" a second shot, as he raced into the thick stuff to my left, met with no response.

The beat finished, G came to me and said that a sambhar stag and four hinds had come right up within ten yards of him, and that he had knocked the stag over, (probably clipped him across the spine) but the stag had got up again and made off pursued by bullets, which had effectually sent Kunjanaw and myself to cover. There was absolutely no trace of blood from the stag, so we went to examine the result of my efforts.

There was a fair amount of blood from the first shot, but the second had hit a sapling and appeared to have missed (I later on found pieces of the nickle casing in the bear's lip). Following up the trail for about mile the blood gave out but it was evident that he was hit severely, low down in the chest, and would lie up close by in the thickest cover he could find on or near the river bank. Accordingly I told the beaters to wait where they were for twenty minutes while we went on and took up our positions, and then to beat along towards us.

The ground, about 200 yards from and parallel to the river rose suddenly about 80 feet to the upper levels, the flat ground on the river bank and the steeprise being thickly covered with forest and undergrowth. It was almost certain that the bear would try to pass along the base of the rise under cover of the thick stuff so I put G there, and myself stood thirty yards on his left and nearer the river. The beat had been started some five minutes, and I was watching a beautiful Chinese Barbet, which had settled on a bamboo just above me, when I heard the bear coming cautiously straight towards G. Having arrived within ten yards of him it stopped—evidently listening. Then G shifted his feet in the dead leaves. I heard the bear making off up the rise beyond him, a stick cracked a hundred yards up the hillside, and silence.

I was annoyed. There was no trace of blood and so no chance of tracking in that thick dry jungle, and there was nothing for it but to go home.

We were walking along, the beaters in a straggling line talking and singing about two hundred yards behind us, when I saw a couple of butterflies (Danaids) which I wanted, and was taking them out of the net, when suddenly the Karen contractor yelled "Pig," and pointed to the slope above me. I saw something black moving through the bushes, and running forward with the rifle, saw the bear not twenty yards away, and put a bullet into him behind the ribs and raking forward. He carried on for a few yards and the Karen fired, hitting him high up in the top of the shoulder, while G fired and missed but nearly took off the top of the Karen's head. The bear had however rolled down against a fallen tree and was quite dead. We carried him down on to the flat ground below, and he proved most interesting. He was an old male, 4′-5½″ long in a straight line, and extraordinarily lanky for his tribe, although obviously in excellent condition. He had a fine ruff, his coat being coarser and his snout being a little longer than the average Himalayan Black Bear (*Selenarctos thibetanus*). His length of leg was remarkable, and all these points were accentuated still further in a second specimen which I obtained later on in Siam. He had been hit low in the chest with my first shot, the bone being smashed and a big hole made, which had just missed the main blood vessels: it was a wonder he had got so far.

We took him back to the hut, where I photographed and skinned him, and was quite glad of an easy by the time I had done the job and treated the skin with arsenical soap.

I found throughout the trip that four specimens of birds or mammals was all I could manage in a day, as after getting into camp I always had my butterflies, maps and diaries to complete as well. A trained skinner would have been invaluable and if there had been one with me I could have brought back five or six times the number of specimens.

I filled my specimens of birds and small mammals with jungle cotton from the "kapok" tree. This "kapok" cotton has the property of refusing to absorb moisture; so much so that waist-coats padded with it were used during the war for life-preserving purposes at sea. The tree is very common in Lower Burma and Siam growing to a height of 100 feet with a rather smooth, light coloured trunk and no branches on its lower third. The gatherers of the cotton drive bamboo spikes into the trunk as a ladder and seem to take great risks out on the slender branches. Often we found a tree in the jungle whose crop had been untouched and which lay thick on the ground, so that we only had to collect it in a sack.

We left Miba on the morning of the 12th February, and after an easy five miles along the flat by the river, we had to climb a high spur, which here forces the Thaungyin to bend to the Eastward. Then "contour chase" for a mile around its crest, and finally drop down to a narrow valley in which was the Kyauket hut. The spur was a stiff climb, and the narrow path was much overhung with "dhi-za" weed, that pest of Burma. It grows to a height of 8 feet, usually in artificial clearings such as abandoned "taungya" cultivation, and it bears a fluffy seed which enters every crevice of the clothes and body. It is extremely dense and wiry; altogether an abominable vegetable. Near the crest of the ridge I shot a fine specimen of the Golden-backed Squirrel (*Callosciurus caniceps*), and in a small open patch near the Kyauket stream, found several interesting butterflies, including *Euthalia cognata* and *E. dirtea*, amongst them. This was my birthday, so I had a special dinner that night, including a bottle of champagne brought for the purpose.

Next day we had a very dull march of 9 miles to Palu where we again came to the Thaungyin. In the village was a young White-handed Gibbon (*Hylobates lar*) in captivity. He was quite tame and friendly, but seemed to spend most of his time hanging by one hand with his legs tucked up and his other arm curled round them, and was duly photographed in that position. He was cream-coloured with a black face, and, as far as I could ascertain, of the many gibbons of this species which I saw in the course of my trip, only the old males were black; the remainder of both sexes varying from whitey-buff to dark brown.

I stayed a day at Palu and had a few beats in the foothills, entirely without result, though I saw tracks of sambhar, bison and tsine. I also found the first of the butterfly assemblies which were such a remarkable feature of Siam, though this was a very small one consisting entirely of Danaids (*Euploea mulciber* mostly) and Pierids.

From Palu we marched twelve miles to the frontier post of Myawadi, generally through mixed forest, very dry in places but full of bird life. The number of woodpeckers was remarkable even for Lower Burma, which has nearly forty species, the most plentiful being the Large Golden-backed and the Little Malay Pied, but there were many others I was unable to identify. Owing to limited time and transport I had decided to confine my bird collecting to game birds and pigeons. I shot a nice specimen of the Burmese Green Pigeon (*Crocopus phœnicopterus*) on this march.

A night in the comfortable rest-house at Myawadi, and next morning (February 16th), having paid off the elephants, we started off with three bullock carts for the baggage, and, passing the small frontier guard of Burma Military Police, forded the Thaungyin, here shallow with a bed of sand and gravel, and entered Siam.

Four miles along a flat road between rice fields (a pleasant change after marching so long through forest) brought us to Me Sau~~k~~, a large straggling village t/ with a good many native shops, which is the headquarters of the district. Here I took up my abode in the guest-house, where I shortly afterwards received a call from the Amphur Nai, or Siamese Deputy Commissioner. He seemed very pleasant and ready to help, and mentioned that he had been expecting me for a fortnight, as apparently no intimation of my deviation across the Ta'ok Plateau from the direct Myawadi route had been sent him. The walls of the guest-house had several pairs of sambhar horns hanging on them, and I was much struck by the fact that there were three sets of hat-pegs of six each, which were made from serow horns ; nine pairs in all. They were none of them very long, 9¼″ being the biggest, but were very thick and most of them had evidently belonged to old males. On enquiry I found that serow are common in the rock hills to the east of Me Sauk and are shot by Karen hunters, who wait patiently for them by their resting-places amongst the rocks to which the serow return regularly after feeding. Later in my journey I was shown two of these resting-places by a Karen hunter who had killed the original occupants. They had evidently been in use for months, and the droppings were inches deep in places. The only thing of the kind I have seen before, are the resting-places of klipspringer which I occasionally found in Somaliland. They had the same habit of using one ledge on a hill-side for months at a time, and of leaving their droppings all round it.

Next morning I called on the officer commanding the local gendarmerie. His verandah was profusely decorated with horns: tsine, (all small and some of them cows), sambhar, serow and barking deer ; also one fair-sized bison bull. None of them had been shot by the owner himself, who was a Malay and a British subject originally, while his wife who was Burmese had been educated in Mandalay and spoke a few words of English. One of the sambhar heads, which was a remarkably fine one for the Malay species, carried the unusual number of 11 points. The extra 5 points were made up by the bifurcation of each top inner tine, and by two large basal snags on the right and one on the left horn. The measurements were :—

	Right Horn.	Left Horn.
Length	34¼″	34″
Girth half way up beam	6″	6″
	Basal Snags.	
Points	(6) 4½″ & 5″	5″
Brow tine, length	20¾″	20½″
„ „ Girth at base	7½″	7½″

All the measurements are big, and the length and girth of the brow tines exceptionally so.

I found it very hard to obtain a photo, as the verandah was very narrow and the trophy firmly nailed to the wall above the level of my head; even by tilting the camera I failed to include the tips of the horns. This pair of horns came from Karenni.

I managed to get away from Me Sauk on February 18th, being much helped by the arrival of the Commissioner of Raheng, who made things move. I may say here that I had considerable influence used to help me on my journey, and without such influence the ordinary traveller will find it very difficult to get along at all in out of the way parts of Siam.

I only marched 5 miles eastwards to the foot of the hills on the 18th and climbed the first range next morning, through dense forest once again. On the crest of the ridge were many fine rock spires, and close where the road passes the biggest of these was a curious shrine consisting of a big wooden table with a canopy over it. On the table were several score of small votive figures. The shrine is dedicated to the spirit of the rocks on the ridge, and the votive figures are placed there by those desiring a cure from sickness.

A short distance beyond the shrine a tree had fallen by the roadside and parallel to it. I paced it and found that it had not been less than 190 feet high; yet by comparison with others around it was, if anything, a little below the average of the forest.

We reached Nam Dip, our halting-place, at about 11 o'clock as it was only about seven and a half miles, and there found a small open space which was so marshy from a nearby spring that I had to pitch camp in the jungle on the edge of the clearing.

While waiting for the coolies, an old male White-handed Gibbon appeared on a tree about 35 yards from where I was resting, and began feeding. He was quite black except for the ring of white hairs round his face, and his hands. He was feeding on small hard fruits, which grew in clusters on the big glossy-leaved, dark green tree, and I noticed that although he often plucked fruit with a foot, he never then put the food directly into his mouth, but always transferred it to a hand first. He was quite alone, and I watched him through my glasses for about half an hour with great interest.

After camp had been pitched I strolled round with the butterfly-net and made the acquaintance for the first time of that beautiful and elusive insect *Parthenos gambrisius*. It is a large butterfly, coloured charmingly in greys and greens and blues; it is also the most annoying of any I have ever tried to catch. I was destined to see one or two nearly every other day for over two months, yet I did not succeed in catching one for six weeks or more. This particular one sailed past me within easy reach, while I was extracting a capture from the net, and settled on a leaf near the edge of the marsh. I stalked him and just as I got within reach, he flitted away and settled on a water plant in the middle of an expanse of filthy mud and water. I sat down and waited, and about ten minutes later he flew across and settled on the far side of the marsh, which was about thirty yards across. I went round and he flew back again. It ended an hour later by his settling on the end of a log which lay half embedded in the mud. I Blondin'd out along it. Just as I got within reach a paddy-bird flew out from under me with a loud squawk, which so startled me that I fell off the log. I then went back to my tent and changed my clothes.

The 20th was uninteresting. After crossing the Paw Waw mountains, a climb of about 500 feet and then a drop of a thousand feet to the Melamoung stream, which we forded at the fifth mile, I pushed on through open jungle and a couple of scattered villages to a pleasant halting place at about 10½ miles where some grand trees grew beside a clear running stream. This seemed an ideal place for lunch, but I was only half-way through it when an approaching series of crashes attracted my attention, and turning in their direction, I saw a large flying squirrel, as I thought, land on the lower branch of a big teak tree. I stalked it, and saw him peering at me over the top of the branch as he clung along its length on the side farthest from me, about ten inches of a black and white tail being curled over my side of the branch. I fired at his head, but without result, and he fled up to the tree-top, and thence by an immense leap into a big dead tree, up which he scampered and took refuge in a collection of dead branches in the topmost fork, and where he was quite safe from my gun. I had to leave him, and am still uncertain as to his species. As he fled he appeared to be grey or " pepper and salt " in colour, with a black and white tail, and I know of no squirrel which answers to that description. He appeared much more like a Flying Lemur than anything else, but I have never heard of one occurring in that area.

The coolies took ten hours over this 13½ miles to Pelot, the evening's halting-place. In Siam they carry their loads slung on bamboos, are very slow and carry very little.

I met a great many bullock caravans on this march. The loads hang from transverse poles the centre of which are fixed in the wooden pack-saddles. The loads are usually packed in large conical baskets, and consist of rice, tobacco or tea. The latter is wetted and pressed almost solid, the packages being a popular medium for smuggling opium. Accompanying these caravans were always several dogs. These dogs are like small Chows; having the same build and close-curled tail, but with a shorter coat. They were usually friendly and quite different to the average Indian village dog, being well fed and looked after by their owners.

Frequently, while resting in a village, I have seen the family have a meal on the outer platform of the bamboo-hut, which is raised 6 or 7 feet off the ground. At the foot of the ladder leading to the platform would be grouped three or four dogs. At the end of the meal a good portion of rice would be turned out on to some matting and the dogs called; whereupon they would hurl themselves up the ladder and set to. The ladder was always of bamboo with single bamboo rungs about 15 to 18 inches apart, yet I never saw a dog miss its footing, and the ascent was a fine feat of canine acrobatics, as they jostled each other hard in the course of it.

On the 21st I met with the most curious natural phenomenon seen during my trip. We first climbed a spur about 800 feet high, and then the path led along the side of a ridge. For not less than a quarter of a mile the track, which was slightly hollowed through the passage of bullocks during the rains, was completely filled with tangled masses of long-legged " Harvester " spiders. Most of them appeared to be dead, but may have been torpid, as it was a cool dewy morning and the slope faced north. A very few seemed to have overflowed on to the ground below the path, and there were a good number for three or four yards above it, but the masses (like the debris of a hair mattress) were confined to the track. I puzzled for a long time over their origin, but found no solution. They ended where the path crossed the ridge and changed over to its south side; then, after crossing a small col and continuing along the north side of the next ridge, there was another smaller stretch of the path about a furlong in extent, again covered with these insects, though not in quite such profusion as on the first instance. In neither track did I see a spider travel. A few waved their legs feebly, but the majority were either torpid or dead. None were brittle and hard, so, if dead, must have died that morning. An explanation seems hard to find. It is said to be unlucky to kill a spider: if so I must have saved up misfortune for years to come, for it was quite impossible to avoid crushing many at every step.

After leaving the second batch of spiders, we began climbing again and eventually reached the crest of the Thaungyin—Meping water-parting at the end of our fifth mile, and at 4,000′ elevation. We dropped down about 200′ of easy grade to a grassy hollow where two small streams joined and butterflies swarmed.

I had a fragmentary lunch as I was continually jumping up, butterfly-net in hand, to try and secure some gorgeous insect. The great black and yellow ornithoptera, *Papilio aëacus* and *Papilio cerberus* were both taken here.

The coolies arrived and we descended a densely-wooded ravine by a very steep path for another 400′ and then struck a gentle down-hill grade, while the bottom of the nullah was open for three or four yards and a clear stream ran over a gravelly bed. It was a naturalist's paradise, and it goes by the name of Pang Yao I am quite unable to describe or do any kind of justice to the beauty of the scenery, the trees, the flowers, the butterflies or the birds ; I can only try and describe a few of the things I saw before I camped that evning, about five miles down the valley. The flowers I can say nothing about being no botanist: they were a confusing riot of gorgeous colouring and curious scents. The birds were in hundreds great and small, and a different species seemed to call, or fly across the track, for every few yards I went. The Broadbills, Woodpeckers, Kingfishers and Flowerpeckers provided the most beautiful colours, Shamas and Laughing-Thrushes most of the noise. But there were numbers of small birds I would not attempt to name or classify.

Then what is it possible to say of the butterflies? How describe the delicate beauty of the carpet of blues I met with settled on damp stretches of the path. I waved my net above them to disturb them and a whirling cloud rose but left, hundreds still settled on the ground ; and, as there was no way round, I had to walk on, leaving a trail of mangled bits of sky behind me. In sandy places the swallow-tails congregated ; *P. antiphates* and *sarpedon*, in delicate and bold shades of green ; *philoxenus* and *demoleus*, the one with red patches the other with yellow relieving the glossy black of their broad wings. These were in groups, while *paris* with his glorious iridescent blue green patches kept himself to himself on the outskirts of the throng. These were myriads of commoner and less beautiful butterflies at the muddier patches, whites mostly, *Huphina* and *Appias* with a sprinkling of yellow *Terias*. The Danaids, mostly *Euploea mulciber* and *diocletianus*, seemed impartial as to whether they chose mud or warm wet sand for their meeting place, but they kept apart from the others forming separate patches of dark-brown. As I pushed through the undergrowth the well known leaf-butterfly (*Kallima inachis*) often darted out ; there was a flick of blue, another of brown, and he was in a bush again or settled amongst dead leaves and almost impossible to detect. At several places where the sun shone on a damp hollow in a small clear space were half a dozen of the strange *Leptocircus curius*, twirling their long tails as they hovered in the sunlight, and looking rather as if they might have a sting somewhere about them.

Emerging suddenly from the undergrowth, we surprised four Silver Pheasants feeding peacefully, and I was just quick enough in snatching the gun from the orderly to knock over a hen before they got back into the forest. On picking her up I was immediately puzzled : there should have been a specimen of *G. nycthemerus sharpei* in my hand, but instead this bird was much more like *G. rufipes*, the Ruby Mines race. In particular the breast feathers corresponded to the latter rather than the former. A few days later I shot a cock bird about half a mile from the same place, and he only differed from *G. n. sharpei* in the colour of the legs. This cock eventually went home to Mr. Stuart Baker, but the fate of the hen was sad. When I got into camp that evening my bearer asked if I was going to skin the bird, but being very tired and as it was nearly dark, I said "No," never thinking but that he meant "Was I going to do it immediately." Next day, on reaching our next camp, I asked forthe pheasant, intending to skin it, and found that it was already plucked. A tragedy indeed ! Fortunately in an idle moment after dinner I had seen one of the breast feathers lying on the floor of my tent, and had picked it up and made a pencil sketch of it in my diary.

Next morning we started early, too early for the butterflies, and scrambled down a couple of miles of very steep and rough track, until we had dropped from 3,000 to 2,000′. Storkbilled Kingfishers and Spotted Forktails were the most conspicuous birds of this bit, while in a small grassy glade a dozen Red Jungle Fowl were feeding. Silver Pheasants could be heard drumming now and then but they were not nearly as noisy as in the evenings. At the bottom of this steep bit there was a great commotion going on in some high trees near the track, several of both species of Racquet-tailed Drongo and a pair of King Crows being strenuously engaged in chasing a couple of Drongo Cuckoos.

I sat down to watch them by a small pool, and the sun came on to a sandbar so that the butterflies began to collect. At first entirely *Papilio aristolochiae* and *Radena similis.* Then came some fine specimens of the great red and black *P. philoxenus* followed by a couple of *P. adamsoni,* also the first specimens I had seen of a quaint moth, which resembled a Danaid in shape and flight and to a certain extent in colouring, having the blue flush on the forewing characteristic of so many Danaids. This moth I found very plentiful later on in the higher valleys of the range further south.

Half a mile on, leaving the main nullah, we crossed a low col into a much less pleasant country of low, leafless forest, rocks and hot stony nullahs. There was little life in this except for Malay Cuckoo Doves, which were perched on the topmost branch of any tree which stood out above the rest.

Half an hour's walking brought me to the gendarmery post at Ban-Kratair, the garrison of a dozen living in a neat pile-built blockhouse on the bank of the Me Taw stream, here choked with teak logs from the valleys above. The Siamese N. C. O. in charge of the post gave me a letter from Mr. Gairdner very kindly offering me the use of his house at Raheng and telling me that he expected to be back there on the 29th of February.

We crossed the Me Taw dryshod on the logs, and after I had shot a Black-backed Squirrel from out of a creeper covered tree, we pushed along another three miles to the Bombay Burma Coy.'s hut at Pang Chang Tai. This last bit of road was remarkable for the number of Tuktoo lizards calling from the trees. As a rule the Tuktoo is rather silent during the day, but here they seemed to call throughout the 24 hours.

Pang Chang Tai is on the edge of a small cliff above the Me Taw, and across the stream is a grove of big forest trees, one of which must have been I think a *Ficus indica* in fruit. For, about 5 o'clock, green pigeon began to cross the clearing by the hut, bursting out of the forest and flying very fast across the open in the direction of this grove. They appeared and were gone so suddenly that they offered but the most fleeting of chances, and I was very pleased to bag seven. These were of three species: the Burmese Green Pigeon (*C. phoenicopterus*) which produced three birds, while there were two each of the beautiful Orange-breasted and the Cinnamon-headed. The deep maroon back of the cock Cinnamon-headed contrasting with the delicate greens of the rest of his plumage makes him one of the most beautiful of this beautiful group of birds. These Cinnamon-headed fly at great speed through the forest, usually low down and singly or in pairs. Twice one darted between me and another of my party, nearly knocking off my topi.

Leaving Pang Chang Tai on the morning of the 23rd, we travelled down the Me Taw for a couple of miles, then crossed the foothills into the main Meping Valley, entering a stretch of flat country of alternate rice-fields and low jungles where the Coucal, Indian Roller and Siamese Hoopoo suddenly became plentiful after several days of absence.

I had to get a change of transport, and decided to retrace my steps a couple of marches to Pang Yao and put in a couple of days collecting there until Mr.

Gairdner was due back in Raheng; so, after a day's real loafing in the very pleasant Bombay Burma Company bungalow at Raheng, I marched back and camped in a shady spot on the grassy slope beside the stream about half a mile below my first site.

Strolling up the valley in the evening I heard a pheasant drumming, and determined to try Oate's trick on him, of calling him with a handkerchief held between the hands and rapidly slackened and tautened. At the first effort, I got response, and my bird came gradually closer until he drummed about 30 yards away. Then he fell silent but had evidently been stalking me, as instead of coming out into the open as I expected, the only thing I saw of him, was his rapid departure across a small opening in the undergrowth about 15 yards away, having evidently caught sight of me in spite of my precautions. This was not at all like Oates' account of their running wildly towards the sound, but I determined to have another try.

Five hundred yards further up the drumming again sounded and I sat down behind a bush on the path and gradually drew him nearer with the handkerchief, until flutterings and rustlings in the bushes a dozen yards away told me that not only was the cock bird there but some of his family as well. I waited patiently, and suddenly a hen pheasant walked out on to the path behind my right shoulder, and not five yards from me, then stood a second in astonishment. Not long enough however for me to get a shot, in spite of a violent contortion which nearly tied me in a knot and appreciably hastened her departure. By now I was spurred to a determination not to quit without securing one of these birds, and I had only another 200 yards to go to hear another drummer. This time as soon as I could hear my bird in the undergrowth a short way in front of me, I rushed in on him, and these tactics were successful, for a fine old cock fled, half running, half flying, and a snapshot brought him fluttering down again. A wonderfully handsome bird with his velvety-black underdress, red eye-patch, and the delicate wavy pencillings of his black and white upper plumage.

On the way back to camp I came suddenly on a covey of seven or eight Green-legged Hill Partridge scratching amongst the dead leaves at the mouth of a small gully, and bagged one of them also; so I had a successful day.

The 27th I devoted entirely to butterflies, with good results. At one point a few large scarlet flowers had fallen from a big tree: these had a deep calyx and thick fleshy petals, some of which had been bruised by the feet of a passing bullock. Papilios began to collect on one of these, and after a careful stalk I clapped the net on to the lot, bagging *memnon, agenor, rhetener, adamsoni* and *philoxenus* at one blow. I got some fine specimens of the great black and yellow *P. œacus* and *Helena cerberus* this morning, and spent half an hour waiting for a Hestia to descend from a branch twenty feet up, and finally, losing patience, threw a twig to disturb it, with the result that it departed for good, floating away over the tree-tops.

I took my only ***Delias hyparete ciris*** here, and found *Huphina nadina amba* common, though I did not come across it again. *Charaxes arja vernus* I only took here. There did not seem to be many species of "blues" though swarms of *Lampides elpis* and *celeno* carpeted moist, shady hollows as before. Of skippers I took very few, ***Baoris farri*** being the commonest here and throughout my journey.

Pang Yao was the first place where I was much worried by the bees. There are four species, two with stings and two much smaller, hairy little species which are stingless. These all persist in settling on any bare skin, and cluster all over one's neck and behind one's ears, also getting between the fingers. The irritation is maddening, and while the stingless species are much the most numerous one is constantly getting stung through brushing away a bunch which includes an unnoticed stinger. They are particularly trying when skinning as they get between the fingers, and when crushed in manipulating the subject retaliate with their stings.

On the 29th I went down to Pang Chang Tai, and at the bottom of the hill saw what I took to be a rather dark specimen of Berdmore's squirrel nosing about under a bush and shot it; then, calling to Maung U to cross the stream and pick it up, I went on to Ban Kratair, where I met Mr. Gairdner. He noticed the little beast in Maung U's hand, and remarked that I had got a Tupaia. Sure enough I had. It was an excusable mistake, for the habits of the two animals are very similar, and they are alike in their general colouration and their jerky movements amongst the fallen leaves.

Mr. Gairdner presented me with two fine specimens of the Grey-headed Imperial Pigeon. These had been caught by a native who, Mr. Gairdner said, netted them in a clapnet as they came down to a small mud-patch higher up the Me Taw. They appear to be unable to keep away from this, as the trapper catches seven or eight a day. These two were the first specimens to reach the B. N. H. S.

I had expected and hoped to shoot some more pigeons at Pang Chang Tai, as all the others had been too knocked about by the force of their fall on the hard ground to be used as Museum specimens, but the attraction on the far side of the stream evidently no longer existed, as we saw only one small batch which flew by out of shot. The only bird of interest, which I secured, was a Little Blue Bittern from the Me Taw stream-bed.

Next day we reached the Meping and crossed the 400 yard wide river in a canoe to the left bank and the straggling houses of Raheng.

(*To be continued.*)

NOTES ON A COLLECTION OF SNAKES FROM SHEMBAGANUR, PALNAI HILLS.

(Circa 7,000 Feet).

By Colonel F. Wall, C.M.G., I.M.S.

A valuable collection of snakes was made for me during 1922 by the Revd. L. Anglade at Shembaganur.

A good deal of new light is shed on the habits of some snakes about which little was previously known. I have added all the additional information available from my note books. My thanks are due to Father Anglade for the trouble taken and specially for the careful way in which every specimen was labelled, giving dates of capture.

Family.—Uropeltidae.

Silybura nigra Beddome.

This is the commonest snake in the Palnai Hills above about 6,000 feet. Thirty-seven specimens were collected this year. Details of these are tabulated below. These details with notes I have made on previous specimens—over seventy in all—shed considerable light on the life habits of the species, and other points of interest. I propose to deal with this snake fully in this paper.

General characters.—The snout is subacute, and not keeled above. The body is moderate in length, and as in other species of this genus, is much swollen for two or three head-lengths behind the head, owing to heavy muscular development, evolved from its habit of burrowing in the soil. The tail is round basally, and not truncate terminally. The tip of the tail has two minute points placed side by side. The diameter of the eye is rather less than one-half the ocular shield.

Colouration.—There are three colour varieties in the Palnai Hills more or less connected by intermediate forms.

(A) Dorsally brown of varying degrees of intensity, with a black mottling tending to form cross-bars, within which some of the scales centrally are yellow. (White in spirit.)

(B) Dorsally black, some scales centrally yellow, producing beaded cross-bars.

(C) Uniform black dorsally. In all the belly is coarsely blotched with yellow. The most anterior blotches are confluent to form a lateral stripe ending on the fourth labial. The head is black above and the tip of the snout black in the young, horn coloured in many adults. The anal region is yellow, and this is continued as a lateral stripe along the tail nearly to its tip. The tip of the tail is black. The yellow spots and blotches are of a buttercup brilliance. The pigment which is soluble in spirit and in water, tinges the preservative appreciably. A recently bottled specimen soon loses its yellow, the pigment passing partly into the spirit, and partly into the subjacent tissues and viscera which are often very strongly tinged. In preparing skulls I have found a specimen denuded of its skin, with about an inch of the forebody attached, will impart a yellow tinge to the water in a small basin in which it is immersed. The internal organs, including eggs, are deeply stained with this pigment after death.

Habits.—It lives for the most part beneath the soil.

Food.—I have only found earthworms in the stomach. The intestines and cloaca are always loaded with liquid mud derived from this diet.

Breeding—(*a*) *The sexes.*—Males appear to be more abundant from the series given below, there being 22 against 15 females. The sexes appear to grow to a similar length, and the length of the fœtuses recorded below is proximately the same. Males have longer tails, and rather more numerous subcaudal shields. The genitalia are cylindrical organs, rather larger in girth distally than basally, and are beset with minute villi. I have not examined these in an adult.

(*b*) *Method of reproduction.*—One of the July specimens noted below leaves no doubt that the species is viviparous.

(*c*) *Season.*—The records cited show eggs in November and December from 6 to 12 mm. long, eggs about 31 mm. long in January to March, containing small embryos, and fœtuses in July.

(*d*) *The brood.*—The brood varies from 4 to 7.

Growth—(*a*) *The Young.*—The fœtuses recorded below varied from 84 to 88 mm. (3^{8} to 3½ inches). The smallest postnatal specimens I have had were 106 to 115 mm. (4¼ to 4⅝ inches.)

(*b*) *Early life.*—The specimens mentioned below ranging from 162 to 185 mm. (6½ to 7 ⅜ inches) in November and December were probably from broods produced in the middle of this year. The growth beyond this cannot be followed.

(*c*) *Maturity.*—The shortest gravid ♀ in the series cited was 185 mm. (7⅜ inches). As most snakes double their length in the first year of life, it seems probable this specimen was about a year old.

(*d*) *Maximum length.*—My largest of over one hundred records was a ♂ 312 mm. (12 ⅜ inches).

Lepidosis—(*a*) *Typical. Rostral.*—Not keeled; usually touching 4 shields sometimes 6. Its length twice to three times its distance to the frontal, subequal to the frontal, one-third to two-fifths the shielded part of the head. *Frontal,* Length two-thirds to three-fourths its distance to the tip of the rostral, equal to or a shade longer than the parietals, one-third to two-fifths the shielded part of the head.

Costals.—19 in the whole body length. *Supracaudals* feebly bi-and tricarinate.

Terminal shield.—With two minute points directed upwards and backwards.

Ventrals.—♂ 164 to 173, ♀ 176 to 191. *Anal.*—Divided. *Subcaudals.* ♂. 8 to 10, ♀ 5 to 7.

(*b*) *Anomalies.*—*Ventrals.*—The last is rarely divided. *Subcaudals.* One or more are sometimes entire.

Parasites.—In all the cloacae I investigated I found small worm-like parasites. These are not attached to the walls of this structure, but lie loose in the mud derived from the intestines of the earthworms ingested. They are the shape of a blunt-pointed carrot, white, and ringed. The largest measured 12 mm. (½ an inch in length). They appear to me to be a linguatulid parasite of the genus *Porocephalus.*

Dentition.—From two skulls in my collection. *Maxillary.* 8, kumatodont.

Palatine.—None. *Pterygoid,.* None. *Mandibular.* 10 to 11, scaphiodont.

Distribution.—Western Ghats south of the Palghat gap (Anamalais, Palnais, Travancore and Tinnevelly Hills).

Serial No.	Date.	Sex.	Length in mm.	Costals.			Ventrals.	Subcaudals.	Shields touching rostral.	REMARKS.
				Two head-lengths behind head.	Midbody.	Two head-lengths before vent.				
1	January or February.	♀	254	19	19	19	177	7	4	Contained 4 eggs about 28 mm. long, containing embryos about 31 mm. long. Label torn but "ary" is legible.
2	10–3–22	♀	266	19	19	19	185	7 R 8 L	4	Contained 4 eggs about 28 mm. long with small embryos within.
3	10–3–22	♂	206	19	19	19	166	8 L 9 R	4	3rd subcaudal entire.
4	0–5–22	♀	131	19	19	19	191	7 R 8 L	4	Last ventral divided.
5	6–5–22	♂	310	19	19	19	165	10	6	
6	?–7–22	♀	225	19	19	19	181	6	4	Contained 3 fœtuses (84 mm. 88 mm. 88 mm).
7	?–7–22	♂	232	19	19	19	172	9	4	
8	?–7–22	♂	240	19	19	19	169	9 R 10 L	4	
9	1–11–22	♂	282	19	19	19	169	9 R 10 L	4	
10	3–11–22	♂	168	19	19	19	171	9 R 10 L	6	
11	3–11–22	♂	285	19	19	19	165	9	4	Many small helminths in cloaca.
12	4–11–22	♂	106	19	19	19	168	9 R 10 L	6	
13	4–11–22	♂	325	19	19	19	166	10	4	
14	5–11–22	♂	112	19	19	19	170	10	6	
15	8–11–22	♂	206	19	19	19	168	9	6	
16	9–11–22	♂	275	19	19	19	169	8	6	2nd and 8th subcaudals entire.
17	10–11–22	♂	210	19	19	19	168	9 R 10 L	4	
18	10–11–22	♀	250	19	19	19	181	6 R 7 L	6	

Serial No.	Date.	Sex.	Length in m m.	Costals.			Ventrals.	Subcaudals.	Shields touching rostral.	REMARKS.
				Two head-lengths behind head.	Midbody.	Two head-lengths before vent.				
19	11–11–22	♀	200	19	19	19	176	6	4	3rd and 6th subcaudal entire.
20	11–11–22	♂	235	19	19	19	167	9	4	
21	12–11–22	♂	240	19	19	19	164	10 R 11 L	6	
22	13–11–22	♀	212	19	19	19	178	7	4	
23	15–11–22	♀	244	19	19	19	176	6	6	Contained 4 eggs about 6 mm. long. An earthworm in the stomach. Last ventral divided.
24	17–11–22	♀	240	19	19	19	184	6	4	
25	22–11–22	♂	262	19	19	19	172	9 L 10 R	4	
26	24–11–22	♀	288	19	19	19	177	7	6	
27	24–11–22	♂	256	19	19	19	169	10	4	5th, 6th and 7th subcaudals entire.
28	27–11–22	♀	318	19	19	19	183	6 R 7 L	6	
29	27–11–22	♀	185	19	19	19	178	7	6	Contained 5 eggs about 10 mm. long. Two helminths (*Porocephali* ?) about 12 mm. long in the cloaca.
30	27–11–22	♀	312	19	19	19	176	5 L 6 R	6	Contained 7 eggs about 12 mm. long.
31	1–12–22	♂	250	19	19	19	170	9	6	
32	1–12–22	♀	300	19	19	19	179	7	6	Contained 7 eggs about 12 mm. long.
33	3–12–22	♂	275	19	19	19	166	9	4	Many small helminths in cloaca.
34	8–12–22	♂	162	19	19	19	169	10	6	
35	?–12–22	♂	225	19	19	19	169	9	4	
36	?	♀	?	19	19	19	179	6	4	Label detached.
37	?	♂	115	19	19	19	173	9 R 10 L	4	Label detached.

Silybura pulneyensis (Beddome).

Six specimens were captured during the year details of which are given below:—

Serial No.	Date.	Sex.	Length in mm.	Costals.			Ventrals.	Subcaudals.	Remarks.
				Two head-lengths behind head.	Midbody.	Two head-lengths before vent.			
38	3– 5–22	♂	262	19	17	17	169	11	2nd subcaudal entire.
39	?– 5–22	♀	243	17	17	17	181	8	
40	?– 5–22	♂	318	19	17	17	167	11 R 12 L	
41	1–11–22	♂	212	19	17	17	164	12	
42	1–11–22	♀	375	19	17	17	174	9	
43	9–11–22	♀	243	19	17	17	169	6 L 8 R	4th subcaudal entire. Contained 2 eggs about 15 mm. ($\frac{3}{8}$ of an inch long).

As more than forty of the species have passed through my hands it may be an appropriate time to put forward all the information at my disposal.

General Characters.—The snout is moderate in length. Body with the usual, strong muscular development in the neck and forebody seen in others of this genus. The tail is feebly compressed, and not truncate. The extreme tip of the tail has a transverse ridge with a slight suggestion of the spines seen in so many others of this genus. The diameter of the eye is half or rather less than half the length of the ocular shield.

Colouration.—Dorsally the colour varies from brown to a deep chocolate. In the lighter specimens all the scales are narrowly edged with chocolate or black. Ventrally the predominating colour is chocolate. A double series of large, irregular-shaped, yellow spots ornament the belly, sometimes confluent to form bars, and with a tendency to be largest in the posterior part. A yellow stripe passes from the fourth labial for some distance along the sides of the forebody. A yellow patch on the anal region is prolonged backwards along the sides of the tail nearly to its tip. The tip of the snout, and tip of the tail are yellow. The yellow as in *S. nigra* stains the tissues and viscera of spirit specimens, and when small pieces denuded of skin are immersed in water, the pigment is dissolved again, tinging that fluid.

Habits.—For the most part subterranean.

Food.—I have only found earthworms in the stomach. The intestines and cloaca are always loaded with semi-liquid mud derived from the intestines of the worms ingested.

Breeding—(*a*) *The sexes.*—Males appear to predominate, 22 out of 37 specimens sexed being of this sex. Out of a brood of 6, 5 proved to be males. Males have relatively longer tails, and more subcaudal shields. There is no sexual difference in length at birth.

(*b*) *Method of reproduction.*—It is viviparous as evidenced by a specimen killed this year by Mr. McCann at Kodaikanal.

(*c*) *Season.*—Mr. McCann's specimen was captured on the 6th of July, and the birth of the young was imminent since the male genitalia were not extruded.

(*d*) *The brood.*—From 2 to 6 are produced in one brood.

Growth (*a*)—*The young*—In the brood referred to above the males varied from 90 to 94 mm. ($3\frac{5}{8}$ to $3\frac{13}{16}$.) inches in length, and the female was 93 mm. ($3\frac{3}{4}$ inches).

(*b*) *Early life.*—My notes furnish no information as to the annual growth.

(*c*) *Maturity.*—An egg-bound ♀ containing two eggs was only 206 mm. ($8\frac{1}{4}$ inches) in length. If this species doubles its length in the first year of life, which is so frequently the case with snakes, this species is sexually mature shortly after its first birthday.

(*d*) *Maximum length.*—My largest, a male measured 375mm. (15 inches) in length. My largest female was 318 mm. ($12\frac{3}{4}$ inches).

Lepidosis—(*a*) *Typical. Rostral.*—Touches six shields ; not keeled above. Its length is twice or nearly twice its distance to the frontal, two-thirds to three-fourths the length of the frontal, and one-quarter to two-sevenths the shielded part of the head. *Frontal.*—Length equal to, or slightly greater than the snout, equal to or a shade greater than the parietals, two-fifths to a half the shielded part of the head. *Costals.* 19 (rarely 17) two heads-lengths behind the head, 17 at midbody, 17 two heads-lengths before the vent. *Ventrals.*—♂ 158 to 180, ♀ 169 to 187. *Subcaudals.*—♂ 11 to 14, ♀ 6 to 9. *Supracaudals.*—Very feebly keeled. *Terminal Shield*—Ends in a transverse ridge at each extremity of which is an extremely minute spine.

(*b*) *Anomalies.*—*Subcaudals.*—One or more are occasionally entire.

Dentition.—*Maxillary.*—8 teeth, feebly kumatodont. *Palatine.*—No teeth. *Pterygoid.* No teeth. *Mandibular.*—9 to 10 teeth, feebly scaphiodont.

Distribution.—Western Ghats south of the Palghat gap (Palnais to Travancore).

Brachyophidium rhodogaster Wall.

A fine series of this snake recently described by me in this journal (Vol. XXVIII, page 41) was collected this year, details of which are given below.

Serial No.	Date.	Sex.	Length in mm.	Costals.			Ventrals.	Subcaudals.	REMARKS.
				Two head-lengths behind head.	Midbody.	Two head-lengths before vent.			
44	5-2-22	♀	104	13	15	15	142	7	
45	14-2-22	♀	137	13	15	15	143	7 R 8 L	
46	10-3-22	♀	179	13	15	15	143	7 R 8 L	Contained 3 eggs about 12 mm. long.

Serial No.	Date.	Sex.	Length in mm.	Costals.			Ventrals.	Subcaudal-.	REMARKS.
				Two heads-lengths behind head.	Midbody.	Two heads-lengths before vent.			
47	?–5–22	♀	112	13	15	15	144	7	Last ventral divided.
48	3–10–22	♀	206	13	15	15	145	7	
49	22–10–22	♀	200	13	15	15	144	8	Contained 5 eggs about 6 mm. long.
50	,,	♀	126	13	15	15	145	7	
51	,,	♂	150	13	15	15	138	10	
52	,,	♀	154	13	15	15	142	7	
53	,,	♂	168	13	15	15	142	10	
54	,,	♂	178	13	15	15	143	11	
55	,,	♂	150	13	15	15	140	9	
56	,,	♀	146	13	15	15	140	7	
57	2–11–22	♀	168	13	15	15	141	10 L 11 R	
58	2–11–22	♂	150	13	15	15	137	10	
59	4–11–22	♂	146	13	15	15	143	10	
60	5–11–22	♂	140	13	15	15	145	10	
61	15–11–22	♂	182	13	15	15	143	10	
62	3–12–22	♀	188	13	15	15	144	7	Contained 4 eggs about 8 mm. long, deeply stained pink.
63	3–12–22	♀	144	13	15	15	143	7	
64	3–12–22	♂	200	13	15	15	138	10 L 11 R	Cloaca infested with many small helminths—(*Porocephali* ?).
65	3–12–22	♀	182	13	15	15	143	7	
66	?	♀	175	13	15	15	145	6R 7L	

I have now seen 30 specimens and gleaned a little of its life habits which may be appropriately given here.

General characters.—This is probably the smallest of the Uropelts as yet known, growing to about 175 to 200 mm. (7 to 8 inches). The snout narrows somewhat but is rounded. The body is short, and of even calibre throughout. There is no special development of the musculature in the forebody so characteristic of species of *Rhinophides* and *Silyburæ.* The tail is conical and ends in a minute point. The diameter of the eye is half, or a shade more than half the length of the ocular shield.

Colouration.—Uniform deep purplish-black dorsally. Belly including the last costal row of scales uniform bright coral pink. Head purplish-black on crown, sides, and muzzle to behind the chin. Sometimes a yellowish lateral mark behind the parietal shields. Tail purplish-black above, coral pink mesially, the terminal point white or whitish.

Habits.—Two sent me this year by Dr. Annandale were found beneath stones in dense jungle at an altitude of 4,200 feet.

Food.—I have not found anything in the stomach to demonstrate the nature of its diet.

Breeding.—(*a*) *The sexes.*—Eleven of the 28 specimens seen by me were males, and the rest females. The male has a slightly longer tail with more numerous subcaudals.

(*b*) *Method of reproduction.*—The eggs found in the type specimen seem to indicate that the species is oviparous.

(*c*) *Season.*—Eggs being found in specimens killed in March, October and December suggests that it is breeding all the year round.

(*d*) *The clutch.*—From 3 to 5 eggs are laid at a time. The largest I have seen measured about 12 mm. (½ inch) long.

Growth.—(*a*) *The young.*—The smallest example was 104 mm. (4⅛ inches) long in February.

(*b*) *Early life.*—My records do not throw any light on the growth.

(*c*) *Maturity.*—My smallest prospective dam measured 179 mm. (7⅛ inches).

(*d*) *Maximum length.*—The largest specimen, a female, measured 206 mm. (8¼ inches).

Lepidosis.—(*a*) *Typical. Rostral.*—Deeper than broad the portion visible above about equal to the suture between the nasals. *Nasals.* Entire. *Praefrontals.* Unusually long, about as long as the frontal. *Frontal.* Length equal to, or rather longer than, the snout, equal to, or rather longer than, the parietals, about one half the shielded part of the head, the fronto-ocular sutures half or less than half the fronto-parietals. *Temporal.*—About half the length of the parietals. *Costals.*—Smooth. Broader than long, the last row about two-thirds the breadth of the ventrals. In 13 rows two heads-lengths behind the head, 15 at midbody, and 15 two head-lengths before the vent. About three to four and a half head-lengths behind the head, the third or fourth row above the ventrals divides. *Ventrals.* ♂ 137 to 145, ♀ 140 to 145. *Anal.*—Divided, about twice the breadth of the ventrals. *Supracaudals.* Very faintly keeled. *Subcaudals.*—♂ 9 to 11, ♀ 6 to 8. *Terminal shield.* Compressed, ending in a point directed backwards.

(*b*)—*Anomalies. Ventrals.*—The last is rarely divided.

Dentition.—*Maxillary.* 9 teeth, kumatodont. *Palatine.* No teeth. *Pterygoid.* No teeth. *Mandibular.* 10 teeth, scaphiodont.

Platyplectrurus madurensis Beddome.

Nine examples were collected during the year, the details of which follow :—

Serial No.	Date.	Sex.	Length in mm.	Costals.			Ventrals.	Subcaudals.	REMARKS.
				Two heads-lengths behind head.	Midbody.	Two heads-lengths before vent.			
67	7- 3-22	♀	442	15	15	15	168	10L 11R	2nd subcaudal entire. Contained 8 eggs about 18 mm. (¾ of an inch) long.
68	10-3-22	♀	480	15	15	15	168	11	
69	?- 5-22	♂	305	15	15	15	167	15	An earthworm in stomach.
70	1-11-22	♀	355	15	15	15	168	11	
71	1-11-22	♀	298	15	15	15	180	11	
72	3-11-22	♀	244	15	15	15	166	10	
73	25-11-22	♀	530	15	15	15	175	11	Contained 10 eggs about 15 mm. (⅝ of an inch) long. Many helminths (*Porocephali* ?) in the cloaca.
74	1-12-22	♂	260	15	15	15	165	15	
75	1-12-22	♂	312	15	15	15	161	15	

I have now seen about 30 examples. This is an opportune moment to record all that is known about the species.

General characters.—The head is depressed, and the snout broadly rounded. The body is unusually long for a Uropelt, perhaps relatively the longest of all the species. The tail is more or less compressed, and ends in a transverse ridge with a short median point. The eye is surrounded by four shields.

Colouration.—Uniform chocolate dorsally. Head muzzle and chin chocolate. Belly chocolate with a central whitish bar on each ventral, and a central whitish spot on the scales of the last three costal rows. Tip of tail whitish. In the young the posterior part of the 3rd and the whole of the 4th supralabials are buff. There is also a buff vertical bar on the neck, nearly meeting its fellow over the nape. Dorsally there are three, trilineate dark brown stripes. The lateral trilineate stripe formed by almost confluent dark spots on the 3rd, 4th and 5th rows above the ventrals, begins in the neck and ends at the vent. The median trilineate stripe formed by similar spots on the vertebral and next adjacent row, begins on the nape and ends about mid tail. The belly is buff, the ventrals and last two costal rows of scales with dark terminal borders.

Habits.—Lives mainly beneath the soil.

Food.—In every case where I have found the stomach full it contained earth worms. The intestines and cloaca are always loaded with mud from this diet.

Breeding—(a) The sexes.—Of 29 sexed, 11 are males and 18 females. The sexes when hatched are of a similar length. Males have rather longer tails with more numerous subcaudal shields.

(*b*) *Method of reproduction.*—It is oviparous in habit. A specimen was killed at Shembaganur in the Palnai Hills having just laid 5 eggs.

(*c*) *Season.*—On the 7th March one contained 8 eggs 18 mm. long. On the 1st of April one deposited 5 eggs 25 to 28 mm. long, and on the 25th of November one contained 10 eggs 15 mm. long. My other egg-bound females had no dates recorded. It is evident that the breeding season covers the greater part of the year.

(*d*) *The clutch.*—From 2 to 10, white, soft-shelled eggs are produced at a time. These measure about 25 to 28 mm. in length and about 6 to 10 mm. in breadth. At the time of deposition minute embryos can be seen cradled within, which measure about 25 mm. (one inch) in length. The eyes and the primary cerebral vesicales can be distinctly seen at this time, but the heart and other viscera protrude, as the abdominal walls have not yet united in the middle line.

(*e*) *Period of incubation.* Not known.

Growth—(a) The hatchling.—I have had 5 specimens which had apparently recently hatched. Four of these were males that ranged from 115 to 143 mm. (4⅝ to 5¾ inches) in length. Three females were 106 and 115 mm. (4½ and 4¾ inches).

(*b*) *Early life.*—The long breeding season makes it difficult to recognise successive broods.

(*c*) *Maturity.*—My smallest egg-bound subject measured 256 mm. (10¼ inches). The tendency for snakes to become more prolific as they advance in age is well illustrated by my notes of this species. The 256 mm. (10¼ inches) specimen contained 2 eggs, the 312 mm. (12¼ inches) specimen 5, the 442 mm. (1 foot 5½ inches) specimen 8, and the 530 mm. (1 foot 9 inches) specimen 10.

(*d*) *Maximum length.*—Much my largest example, a female, measured 610 mm. (2 feet) in length. My largest male was only 362 mm. (1 foot 2½ inches).

Lepidosis—(a) Typical. Rostral.—About as broad as high ; touches 4 shields. The portion visible above about as long as the suture between the nasals. *Nasals*—Entire. *Præfrontals.* About as broad as long. *Supraoculars.* About as long as the præfrontals, about three-fourths the length of the frontals, three-fifths to two-thirds the parietals, equal to the temporal. *Frontal.* Length subequal to the snout, about three-fourths the parietals, and one-third the shielded part of the head. *Præocular.* None. *Postocular.* One, rather shorter than the diameter of the eye. *Supralabials.* Four, the 3rd touching the eye. *Infralabials.* Four, the first meet behind the mental. *Sublinguals.* One pair, separating the mental from the 1st ventral shield. *Costals.* Broader than long, smooth. The ultimate row about three-fourths the breadth of the ventrals. In 15 rows in the whole body length. *Ventrals.*—♂ 161 to 175, ♀ 166 to 180. *Anal.* Divided. About three seconds the breadth of the ventrals. *Supracaudals.* Not keeled. *Subcaudals.* ♂ 14 to 15, ♀ 10 to 12. *Terminal Shield.* With a transverse ridge ending mesially in a small point.

Anomalies—Ventrals.—The last is sometimes divided.

Dentition.—Maxillary. 8 teeth, kumatodont. *Palatine.*—No teeth. *Pterygoid.* No teeth. *Mandibular.* 9 teeth, kumatodont.

Distribution.—Western Ghats south of the Palghat gap (Palnai to Travancore Hills).

FAMILY—COLUBRIDAE.

Xylophis perroteti (Dumeril and Bibron).

Four specimens of this species were included in the collection details of which appear below :—

Serial No.	Date.	Sex.	Length in m m.	Costals.			Ventrals.	Subcaudals.	REMARKS.
				Two head-lengths behind head.	Midbody.	Two head-lengths before vent.			
76	20–11–21	♀	330	13	13	13	139	18	Contained 4 eggs about 18 mm. ($\frac{3}{4}$ of an inch) long.
77	11–11–22	♂	290	13	13	13	133	28	Contained 6 eggs about 15 mm. ($\frac{5}{8}$ of an inch) long. Many minute helminths in cloaca (*Porocephali ?*).
78	15.11–22	♀	386	13	13	13	141	19	
79	15–11–22	♂	?	13	13	13	133	29	

Above 6,000 feet the five species referred to seem to be about the only snakes found in these Hills.

BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA, BURMA AND CEYLON.

REPORT NO. 37, NEPAL.

BY MARTIN A. C. HINTON AND T. B. FRY.

COLLECTION ...	... No. 37.
LOCALITY ...	... Nepal.
DATE ...	... August 1920 to March 1921.
COLLECTED BY	... Lt.-Colonel R. L. Kennion with the assistance of the Society's Collector, N. A. Baptista.

The researches of Brian H. Hodgson in Nepal, made between 1823 and 1843, laid the foundations of Himalayan mammalogy. Owing to the imperfect and confused labelling of Hodgson's specimens a modern collection from the neighbourhood of Katmandu has been a desideratum for many years. While the work of the Mammal Survey in the adjoining countries of Kumaon and Sikkim cleared up much that was obscure, it did not supply the necessary topotypical material by means of which alone a sound judgment could be formed as to the status of the many nominal species described by Hodgson as being peculiar to Nepal. In these circumstances the present collection forms one of the most useful and interesting contributions to Indian mammalogy yet made by the Mammal Survey. In drawing up this report we have seized the opportunity to examine the Hodgson M.S. and drawings, both those belonging to the British Museum and those in the library of the Zoological Society, and to collate them with Hodgson's specimens in the national collection. This work has been done pretty thoroughly for all orders, with the exception of the Ungulates, which must be reserved for a future occasion. As a result we are able to give below a complete list of the mammals of Nepal so far as they are now known; and also a list of those species erroneously, though commonly, reputed to have been found in Nepal.

From this report it will be seen that there are still many gaps in our knowledge; and that many species, especially among Chiroptera, Insectivora and Rodentia, represented in the Survey collections from Kumaon and Sikkim are still unknown from Nepal, although they probably have representatives in the latter country. It is to be hoped that the Survey Collector will obtain these, together with material representing the species still known to us only by Hodgson's specimens.

The Committee of the Society have asked us to record here their grateful thanks to General H. H. Sir Chandra Shumshere Jung

Bahadur Rana, G. C. B., G. C. S. I., G. C. V O., D. C. L., the Prime Minister of Nepal, for the help and assistance he has provided our collector.

The special thanks of the Society are also due to Lt.-Col. R .L. Kennion, late Envoy at Katmandu, for the first part of the present collection, which was made by him personally; for superintending the work of Baptista, who made the second part of the collection; and for so kindly supplying us with much valuable topographical information.

The Zoological Society of London must also be thanked for lending us the priceless Hodgson M.S. and drawings from its library. Without that loan it would have been quite impossible to have made full use of this collection.

In preparing the following notes upon the physical configuration of Nepal we have made free use of the account given in the "Imperial Gazetteer". The State consists of a long narrow rectangular strip of country, with an area of about 54,000 square miles, trending from the north-west to the south-east, its S. E. extremity being in latitude 26° N. longitude 88° E., and its N. W. corner in latitude 30° N. longitude 80° E. As a Himalayan State it is a country carved in high relief, of diversified surface, and variable climate. Broadly speaking it is traversed from W. to E. by three parallel longitudinal valleys, separated or bounded by three ranges of hills, the altitudes of the valley floors and the heights of the hills increasing as we go northwards towards the Tibetan frontier which passes more or less along the crest of the Himalayas proper.

Dealing with these leading physical features in order, we note first that the southern border of Nepal is formed by a lowland belt, the *Tarai*, from 10 to 30 miles wide, the altitude of which varies between 200′ and 300′ above sea-level. The Tarai is formed in part by open country under cultivation and in part by primeval jungles, the latter consisting for the most part of dense forests of Sal intermixed with Sissum, Semal (cotton trees), and near the hills, Char (*Pinus longifolia*). In places it is quite impenetrable, owing to the luxuriant undergrowth and the tangle of giant creepers swinging from tree to tree. The forest is occasionally interrupted by grass which often reaches a height of 10 or 15 feet. In the low-lying portions, particularly in the eastern Tarai, there are swampy tracts clothed with elephant grass, which in some places is so dense that not even elephants can force their way through. Quicksands and bogs, often of a most dangerous character, are of frequent occurrence.

Along the northern margin of the Tarai, at all events westward of the Kosi River, a low range of sandstone hills—the Siwaliks—rises to a height of about 2,000′ and extends almost continuously westward through Nepal except where breached by transverse rivers. Behind to the north of this range are longitudinal valleys (each containing a lateral stream tributary to one of the transverse rivers of the country), which separate the Siwaliks from the median range of hills next to be noted. These longitudinal valleys are called "*Dhuns*" and their floors lie at levels of from 500′ to 1,000′. Into them open the narrow ravines which furrow the southern face of the median range. Both the Siwaliks and the Dhuns are clothed with dense jungle.

To the north of the Siwaliks and Dhuns rises the median or Mahabharat Range, which attains heights of 7,000′ to 8,000′, passing continuously through the country from east to west, except where pierced by the chief transverse rivers. Of these there are three, *viz.*, the Kosi, Ganduk and Kawnala, named in order from east to west. Lateral branches of these have excavated great longitudinal valleys which separate the Mahabharat Range from the main or northern chain of the Himalayas. Lofty ridges leaving the main chain of the Himalayas at right angles, connect the main chain with the Mahabharat Range and form the water partings between the basins of the three rivers above named. Similar ridges bounding the great gorges which furrow the southern slopes of the Himalayas proper jut into the longitudinal valleys from the north at intervals between these divides but, of course, do not effect a junction with the Mahabharat Range.

The divide between the Kosi and Ganduk basins is of especial interest. It is formed by a great ridge leaving the main chain of the Himalayas at Gosainthan. Passing southward it bifurcates some miles to the north of the line of the Mahabharat Range, and encloses in the bifurcation the great valley of Katmandu.

The floor of this valley, lying at an altitude of about 4,700′ is an undulating plain of ovate form measuring about 20 miles from north to south and about 12 miles from east to west. It is completely surrounded by hills of moderate elevation (7,000′ to 9,000′) except to the south at Ferping, where a narrow and deep gorge carries the small river Baghmati, draining the valley of Katmandu, out towards the plain of the Ganges. According to an ancient tradition the valley of Katmandu was once a large and deep lake; and this seems to be possible in view of its geological structure.

According to the Gazetteer all the valleys of central Nepal (that is between the Mahabharat Range and the Himalayas proper) are well watered, highly cultivated, and often densely populated. The climate varies naturally with the altitude and rainfall. In the Katmandu Valley it is very good, much like that of southern Europe, but moister. The average rainfall at Katmandu is about 56·5 inches per annum, half of which falls in the months July and

August, while the greater part of the remainder falls in June and September. The average temperature recorded for each of the four months January, May, July and November is respectively 51°·9, 71°·6, 77°, and 60°·2.

Zoologically speaking the Tarai, Siwaliks, Dhuns and the lower slopes of the Mahabharat Range are strictly oriental, at all events as regards the mammal fauna; and the mammals of this part of the country are for the most part identical with those inhabiting Bengal. Among the larger mammals, elephants, rhinoceros, sambhur and tiger are characteristic. With these, in the Tarai, occur buffalo, chital, hog-deer and swamp-deer. In the dhuns, bison replace buffalo and the characteristic swamp animals of the Tarai are, of course, absent.

At higher levels on the Mahabharat Range, in the valley of Katmandu, and on the still higher slopes to the north of that valley the character of the fauna gradually changes, the Oriental forms disappearing and being replaced by Palearctic types. Many of the species which occur in this transition region are, if not peculiar to Nepal, at least peculiar to that country and the corresponding zones of Kumaon and Sikkim. Among the characteristic large animals of the higher valleys may be mentioned burrhel, thar and true bears.

The following is a list of the stations at which mammals were collected by Lt.-Col. Kennion or Baptista. We are greatly indebted to the former for supplying us with information as to the whereabouts and altitudes of these localities.

A.—LOCALITIES IN THE TARAI (altitudes of each about 300′).

1. Bankulwa Morang. In Tarai E. of Kosi River.
2. Hindulwa Morang. ,, ,, ,, ,, ,, ,,
3. Bairaglia. In Tarai on Baghmati River on Nepal-Indian frontier.
4. Baria Patherghatta. In Tarai to the North of Bairaglia.
5. Hazaria Patherghatta. ,, ,, ,, ,, ,, ,,
6. Tribinia. On Ganduk River on Nepalese-Indian frontier (possibly a Dhun locality; but altitude 300′).

B.—LOCALITIES IN THE DHUNS.

7. Hetwada about 30 miles S.S,W. of Katmandu in the valley of the Rapti; altitude about 1,000′.
8. Partapur. Lower down the Rapti Valley between Hetwada and Tribinia; altitude about 700′.
9. Sunachir. ,, ,, ,, ,, ,, ,, ,,

C.—LOCALITIES IN OR IMMEDIATELY AROUND THE VALLEY OF KATMANDU.

10.	Katmandu	Altitude 4,500′.
11.	Changoo	,, ,,
12.	Hathiban	,, 5,000′.
13.	Ferping	,, ,,
14.	Chalna-Khel	,, 5,000′?

15. Thankot .. .. Altitude 5,000′.
16. Bouzini .. Probably near 14 and 15.
17. Godaveri.. .. .. „ 5,000′. 12 miles S. of Katmandu.
18. Kakani .. .. „ 7,000′.
19. Nagarkot.. .. .. „ „
20. Sipari .. .. „ 6,000-8,000′.

D.—LOCALITIES IN BASIN OF GANDUK.

21. Nawakot. Altitude 3,000′ in valley, 20 miles N. W. of Katmandu.
22. Laharipava „ 11,000′
23. Ramchie „ „
24. Thunsi „ „
25. Parchung „
26. Pattibhagan „ 8,000′

"These places are I think situated in valleys N. of Katmandu in main range, about 40 to 50 miles from Katmandu; the elevations given probably about right.—*R.L.K.*

In the following pages the material collected for the Mammal Survey is listed in the way customary in these Reports—the enumeration of the specimens following immediately upon the statement as to synonymy. The word "Hodgson" appearing after the enumeration indicates either that specimens are also in the Hodgson collection, or that Hodgson has left satisfactory evidence that the species was known to him as inhabiting Nepal.

(1) MACACA MULATTA, Zimm.

The Rhesus.

(For synonymy see Hinton and Wroughton, J.B.N.H.S., xxvii. p. 668.)

Nagarkot, 7,000′, ♀ 2; Hazaria Patherghatta, 300′, ♂ 1. "Hodgson."

(*See* also Reports Nos. 7, 14-16, 19, 23, 25-27, 35-37.)

The facts which necessitate the substitution of Zimmermann's *mulatta* for Audebert's *rhesus* as the technical name of this species have been discussed in the paper by Hinton and Wroughton cited above.

This is the "*Macacus* (*Pithex*) *oinops*" of Hodgson, who gives its distribution in Nepal as the Tarai and Saul Forest together with the lower and central hilly regions.

"Found all over Morang and Patherghatta. This monkey congregates in large troops in heavy forest. Twice a day, morning and evening, they come near the river to drink water, and they are very shy. The call is "*Pio*" repeated frequently and recognised as a warning signal.—*N.A.B.*

(2) MACACA ASSAMENSIS, McCl.

The Assam Macaqua.

(For synonymy, see Hinton and Wroughton, J.B.N.H.S., xxvii., p. 669.)

"Hodgson."

(*See* also Reports Nos. 20, 23, 26.)

This is the "*Macacus* (*Pithex*) *pelops*" of Hodgson who states it to be restricted in Nepal to the "northern hilly region." Although no specimens are included in the survey collection now before us, good material was obtained by the Mammal Survey in Sikkim. (*See* Report No. 23, and Hinton and Wroughton *loc. cit. supra.*)

(3) PITHECUS SCHISTACEUS, Hodgs.

The Himalayan Langur.

(Synonymy in No. 15.)

Hazaria, 300′, ♀2.

" Hodgson."

(*See* also Report No. 15.)

In describing the distribution of this species Blanford (p. 30), says : " As stated under the last species (*i.e.*, *entellus*), it remains to be seen whether the Langurs of the Tarai and lower Himalayan slopes are not *P. entellus.* I can find no record, by a competent naturalist, of *P. schistaceus* below 5,000′ or 6,000′." Hodgson in his Catalogue (J. A. S. B., x., 907) states its chief habitat in Nepal to be the Tarai and Lower Hills and says that it occurs more rarely in the Central and even in the Northern Hilly regions. The specimens obtained by Baptista at Hazaria are most characteristic examples of *schistaceus* and fully confirm Hodgson's statement that the species occurs in the Tarai. In Kumaon too, specimens were obtained by the Mammal Survey at the low elevation of 1,100′ ; and from that station (Ramnagar) it was observed up to heights of about 9,000′. (Report No. 15).

The distribution of this species would therefore seem to afford an interesting parallel to that of *Macaca assamensis* which, although a characteristic Himalayan species, has also an out-post in the Sunderbuns (Anderson, P. Z. S., 1872, p. 529 ; Hinton and Wroughton, J. B. N. H. S., xxvii., p. 667).

" Vernacular names :—*Langur* (Mallaha) ; *Derdoa* (Pahari). This Langur is fairly plentiful in Hazaria near the bank of the Soonsori River. They are not very shy. The call is "*Hoop* ! *Hoop* !" generally uttered as a warning call by one of the troop."—*N.A.B.*

(4) ROUSETTUS LESCHENAULTI, Desm.

Leschenault's Fruit Bat.

(Synonymy in No. 11.)

" Hodgson".

(*See* also Reports Nos. 11, 15, 16, 17, 22, 27, 28.)

This is Hodgson's "*Pteropus pyrivorus*". He obtained it in the great valley of Nepal at 4,000′ where, according to the manuscripts in the library of the Zool. Soc., it occurs " rarely in autumn."

(5) PTEROPUS GIGANTEUS LEUCOCEPHALUS, Hodgs.

Hodgson's Flying Fox.

1835. *Pteropus leucocephalus,* Hodgson, J. A. S. B., iv., p. 700.
1912. *Pteropus giganteus leococephalus,* Andersen, Cat. Chir., B. M., i., p. 333 (*q. v.* for full synonymy).

"Hodgson".

Hodgson's original specimen was obtained on January 31, in the valley of Nepal near Katmandu. In his M. S. he describes it as " sleeping in a tree, a passenger never seen here before". Another of his notes states this form to be " very rare in hills, very common in plains or Tarai".

This subspecies is now known to occur in Kooloo, Nepal, Assam, Cachar, Manipur and is recorded with doubt from Arrakan and Pegu. No specimens have yet been obtained by the Mammal Survey.

(6) CYNOPTERUS BRACHYOTIS ANGULATUS, Mill.

The Malay Short-nosed Fruit Bat.

(Synonymy in No. 17.)

" Scully".

Scully (J. A. S. B., lvi., p. 239, 1887) described two specimens which he collected in Nepal, one being from the Nowakot district, the other from just within the valley of Nepal. These he referred to " *C. marginatus* " pointing out that the measurements "accord best with those of *C. brachyotis* from S. Andaman Island". Andersen (*Cat. Chir.* p. 611) includes Scully's " *marginatus*" doubtfully in the synonymy of *C. brachyotis angulatus*, Miller, a form otherwise not known to occur nearer to Nepal than in Assam (North Lakhimpur.)

(7) RHINOLOPHUS PERNIGER, Hodgs.

The Himalayan Horseshoe Bat.

(Synonymy in No. 14.)

Chalna-Khel, ♀ 1; Bouzini, ♂ 1.

" Hodgson".

(*See* also Reports Nos. 17, 23 and 25.)

Hodgson's type was obtained from "the Forest of Hatiban" in the great valley of Nepal.

(8) RHINOLOPHUS PEARSONI, Horsf.

Pearson's Horseshoe Bat.

(Synonymy in No. 15.)

Parchung, ♂ 1.

(*See* also Reports Nos. 15, 26.)

(9) RHINOLOPHUS MACROTIS, Hodgs.

The Large-eared Horseshoe Bat.

1844. *Rhinolophus macrotis*, Hodgson, in Blyth, J. A. S. B., xiii., p. 485.
"Hodgson". " Central valley of Nepal".

This species described from the Central valley of Nepal and known also from Mussoorie, has not yet been obtained by the Mammal Survey. Closely related to *R. pearsoni*, according to Andersen, it is distinguished by its smaller size, larger ears and relatively longer third metacarpals.

(10) RHINOLOPHUS FERRUM-EQUINUM TRAGATUS, Hodgs.

Hodgson's Horseshoe Bat.

(Synonymy in No. 23.)

" Hodgson".

This well marked subspecies was described from the Central valley of Nepal, where Hodgson found it to be " permanently present in outhouses " at an altitude of 4,000′. It also occurs in Sikkim, where specimens were obtained both by Hodgson and by the Mammal Survey.

(11) RHINOLOPHUS AFFINIS HIMALAYANUS, K. And.

The Allied Horseshoe Bat.

1905. *Rhinolophus affinis himalayanus*, K. Andersen, P.Z.S., 1905, p. 103.
Parchung, ♂ 1 ; Thankot, ♂ 1, ♀ 1.
" Hodgson."

(12) RHINOLOPHUS SUBBADIUS, Blyth.

1844. *Rhinolophus subbadius,* Blyth, J. A. S. B., xiii., p. 486.
1891. *Rhinolophus minor,* Blanford (in part ; *nec.* Horsfield), Mamm. No. 154.
"Hodgson."

(13) HIPPOSIDEROS ARMIGER, Hodgs.

The Great Himalayan Leaf-nosed Bat.

(Synonymy in No. 14.)

Pattibhagan, ♂ 1 ; Bouzini, ♂ 14.
" Hodgson."
"Scully." Ind. Mus. Collector, 1871.

(*See* also Reports Nos. 15, 16, 20, 25, 26, 28.)

Hodgson obtained this bat in the Central valley of Nepal at an altitude of 4,500′.

" Very common in Nepal at all seasons " (Scully).

(14) HIPPOSIDEROS FULVUS, Gray.

The Bicoloured Leaf-nosed Bat.

(Synonymy in No. 3.)

? Hodgson M. S. (Zool. Soc.) vol. 1, p. 8, fig. 3.
" Scully."

There is evidence (although no specimens are now known) that Hodgson obtained a second and smaller species of *Hipposideros* in Nepal. Andersen (P.Z.S., 1905, p. 139) pointing out that Hodgson's " *Vespertilio subbadia* " J. A. S. B., x., p. 908, 1841) is a *nomen nudum* and not identical with Blyth's *Rhinolophus subbadius,* as Blyth supposed, adds :—" the head of this Bat is figured in Hodgson's unpublished drawings, pl. 8, fig. 3 ; it is not a *Rhinolophus,* but a *Hipposideros,* probably *H. bicolor* or an allied form." Hodgson obtained his specimen from the Central valley of Nepal at an altitude of 4,000′.

Scully (J. A.S. B., lvi, p. 248) refers three specimens which he captured in the valley of Nepal to this species.

(15) HIPPOSIDEROS CINERACEUS, Blyth.

The Little Leaf-nosed Bat.

1853. *Hipposideros cineraceus,* Blyth, J. A. S. B., xxii., p. 410 ; K. Andersen, A.M.N.H. (9) ii, p. 384 (1918).
1871. *Phyllorhina amboinensis,* Peters, M. B. Akad. Berlin, 1871, p. 323.
1872. *Phyllorhina micropus,* Hutton, P.Z.S., 1872, p. 703.
1891. *Hipposiderus amboinensis,* Blanford Mammalia, No. 167.
" Scully."

Two specimens were obtained in the Nepal valley by Scully who referred them to *Phyllorhina amboinensis.* The fore-arm measurements 1″·4 and 1″·37 ; (35·3—34·8 m.m.) recorded by Scully agree with those of the present species.

(16) LYRODERMA LYRA, Geoff.

The Indian Vampire Bat.

(Synonymy in No. 1.)

Hazaria, 300′, ♂ 1, ♀ 2.

(*See* also Reports Nos. 4-9, 12, 14, 15, 19, 22, 23, 27.)

This bat has not been hitherto definitely known to occur in Nepal, where it is not improbably restricted to the Tarai and the lower slopes bordering upon it. Hodgson (as has already been pointed out by Andersen and Wroughton, A. M. N. H. (7), xix., p. 135, did not become acquainted with the species until after his removal to Sikkim; and the specimens in his collection, though at one time erroneously labelled as being from Nepal, came in fact from the latter country. In his M.S. Hodgson gives the habitat as "Tarai of Sikkim."

"I saw of these bats only eight in a hole in a tree. I could only catch three. The inhabitants of this place (Hazaria) told me that these bats are very common in the beginning of May."—*N. A. B.*

(17) NYCTALUS LABIATUS, Hodgs.

The Indian Noctule Bat.

(Synonymy in No. 25.)

"Hodgson". "Scully".

(*See* also Reports Nos. 26, 28.)

Obtained from the valley of Nepal at 4,000′ (Hodgson M.S.). "Not common in the Nepal valley. Mr. Hodgson says that it is found there throughout the year, does not hibernate, and quests for food solitarily" (Scully). Scully and Hodgson each seem to have obtained single specimens.

(18) PIPISTRELLUS BABU, Thos.

The Babu Pipistrel.

(Synonymy in No. 26.)

Kakani, ♂ 1.
"Hodgson"?

(19) PIPISTRELLUS COROMANDRA, Gray.

The Coromandel Pipistrel.

(Synonymy in No. 5.)

Hazaria, 300′, ♀ 2; Bairia, 300′, ♂ 4, ♀ 4; Bairaglia, 300′, ♂ 1, ♀ 1.
"Hodgson". "Scully". (Ind. Mus.)

(*See* also Reports Nos. 2, 9, 11, 13-15, 19, 23, 26-29.)

"Mr. Hodgson presented five examples of *Vesperugo abramus*, obtained in Nepal, to the British Museum; but he does not appear to have discriminated the species, as he gave no name to it." (Scully, J. A. S. B., lvi., p. 251.)

Scully states this to be "a very common species in the Nepal valley where it is to be found at all seasons".

(20) PIPISTRELLUS MIMUS, Wrought.

The Southern Dwarf Pipistrel.

(Synonymy in No. 1.)

(*See* also Reports Nos. 2, 3, 5-13, 15, 18-20, 23, 25, 27.)
Bairia, 300′, ♂ 11, ♀ 7; Hazaria, 300′, ♀ 1.

(21) MYOTIS FORMOSUS, Hodgs.

Hodgson's Bat.

1835. *Vespertilio formosus*, Hodgson, J. A. S. B., iv., p. 700; Blanford Mammalia No. 210.

"Hodgson".
"Valley of Nepal, 4,000′" (Hodgson M.S.)

Apparently rare in the valley of Nepal; Hodgson obtained only one example there and Scully failed to find it.

(22) MYOTIS MURICOLA, Gray.

The Wall Bat.

(Synonymy in No. 17.)

"Hodgson".

(*See* also Reports Nos. 23 and 27).

"Valley of Nepal, 4,000′". (Hodgson M.S.)

(23) MYOTIS SILIGORENSIS, Tomes.

The Darjiling Bat.

1855. *Vespertilio siligorensis,* Tomes, in Horsfield, A. M. N. H., 2, xvi, p. 102.

1891. *Vespertilio mystacinus,* (in part) Blanford, Mammalia, No. 211.

"Scully".

(*See* also Report No. 15, under *darjelingensis.*)

"This is one of the commonest bats in the Nepal valley. It may be seen every evening throughout the year, flying rather high in the air." Scully, J. A. S. B., lvi., p. 254.

(24) MYOTIS NIPALENSIS, Dobson.

The Nepal Bat.

1844. *Vespertilio pallidiventris,* Hodgson, Calc. J.N.H., iv., p. 286, Gray, 1846, 1863 (*nomen nudum*).

1871. *Vespertilio nipalensis,* Dobson, Proc. As. S. B., 1871, p. 214, Mon. As. Chir, p. 141, (1876); Cal. Chir., B.M., p. 302, (1878); Scully; Blanford Mammalia No. 207.

"Hodgson".

Indian Mus. Collector, 1871. (Type 172*a* Calcutta).

Although this small bat has been treated (in the absence of material) as a synonym of *caliginosus* or of *siligorensis* it seems to be a perfectly distinct species characterized by having its lower surface pure white. Forearm according to Dobson 34·5 m.m. Both Hodgson's original specimen and that obtained by the Indian Museum Collector in 1871 came from the valley of Nepal. It is to be hoped that further material of this bat will be procured. Quite possibly it is really a species of *Leuconoe* and not a *Myotis* at all.

(25) MURINA HUTTONI, Peters.

The White-bellied Tube-nosed Bat.

(Synonymy in No. 15.)

"Scully"

A single specimen was obtained by Scully in the Nepal Valley in September (J.A.S.B., lvi., p. 251).

(26) MINIOPTERUS FULIGINOSUS, Hodgs.

Hodgson's Long-winged Bat.

(Synonymy in No. 15.)

"Hodgson." "Scully."

(*See* also Reports Nos. 13, 16 and 22.)

"Valley of Nepal, 4,000′." (Hodgson M.S.)

Hodgson says that this species remains in Nepal throughout the year and does not hibernate, and that it is solitary in habit when hunting for its prey.

Scully obtained a single specimen in the Nepal Valley.

(27) HEMIECHINUS COLLARIS, Gray and Hardw.

Hardwicke's Hedgehog

(Synonymy in No. 3.)

"Hodgson."

Hodgson (1841) records three species of "*Erinaceus*," *viz.*:—"*spatangus*," "*collaris*" and "*grayii*," as inhabiting the central region of Nepal; "*spatangus*" and "*grayii*" are, of course, synonyms of *collaris*.

There is no material in the Hodgson collection and as far as we are aware this is the only reference which exists concerning the occurrence of a hedgehog in Nepal.

(28) TALPA MICRURA, Hodgs.

The Short-tailed Mole.

(Synonymy in No. 23.)
"Hodgson."

(*See* also Report No. 23.)

Hodgson sent specimens of this mole home in November 1841. He gives its habitat as the Central and Northern hilly regions of Nepal.

(29) SORIÇULUS NIGRESCENS CENTRALIS, Hint.

The Sikkim Brown-toothed Shrew.

1922. *Soriculus nigrescens centralis*, Hinton, J. B. N. H. S., Vol. xxviii., p. 1054· Bouzini, ♂ 3, ♀ 1.

Owing to the natural tendency to ascribe Hodgson's specimens to "Nepal" and to the insufficiency of the original labels, Blanford was led to give both Nepal and Sikkim as the habitat of this species. But as shown in the paper just cited, all the specimens collected before the work of the Mammal Survey came either from Sikkim or from Bhutan, and the species was consequently quite unknown to occur in Nepal. Now that it has been discovered in the latter country it is not surprising to find that its representative there is a distinct subspecies differing from the typical form by its darker colour, larger size, and peculiar bodily proportions.

(30) PACHYURA, sp.

The Musk Shrew.

Nagarkot, 8,000', ♂ 2, ♀ 1; Godaveri, 7,000', ♀ 1; Sunachir, ♀ 1; Bouzini, ♂ 1; Bairia, 300', ♂ 3, ♀ 3; Hazaria, 300, ♂ 3, ♀ 4.

"Hodgson".

We hope to take up the revision of the Indian White-toothed Shrews in earnest shortly and therefore refrain from offering any remarks upon these most difficult animals on the present occasion.

(31) CROCIDURA RUBRICOSA, And.

Anderson's Assam Shrew.

(Synonymy in No. 25.)

Katmandu, 8,000' (unsexed).

(*See* also Reports Nos. 25, 36.)

(32) FELIS TIGRIS, Linn.

The Tiger.

1766. *Felis tigris*, Linnaeus, Syst. Nat. i., p. 61. (Omitted by mistake in Report No. 11).

"Hodgson".
H. M. the King.

(33) FELIS PARDUS, Linn.

The Panther.

(Synonymy in No. 5.)

" Hodgson".

Both the Tiger and the Panther are, according to Hodgson, generally distributed over Nepal.

(34) FELIS VIVERRINA, Benn.

The Fishing Cat.

(Synonymy in No. 18.)

Bankalwa Morang, ♂ 1.
" Hodgson".

In his M.S. Hodgson speaks of this as the " common Wild Cat of the Tarai".

(35) FELIS BENGALENSIS, Kerr.

The Leopard Cat.

(Synonymy in No. 11.)

" Hodgson".

(*See* also Reports Nos. 14-17, 20, 23, 25, 31.)

For this species Hodgson used at different dates the specific names " *nepalensis*" and " *pardochrous*". According to his M.S. it inhabits the woods of the central region of Nepal.

(36) FELIS NEBULOSA, Griffith.

The Clouded Leopard.

1821. *Felis nebulosa*, Griffith, Carnivora, p. 37; Blanford, Mamm. No. 32.
1825. *Felis macroscelis*, Temminck, Horsf. Zool. Journ., i., p. 543. Hodgson, 1841.
1844. *Felis macrosceloides*, Hodgson, Calc., J. N. H., iv., p. 286.
" Hodgson".

Inhabits the Central Region of Nepal. (Hodgson).

(37) FELIS TEMMINCKI, Vigors, and Horsf.

(Synonymy in No. 14.)

" Hodgson".

(*See* also Report No. 16.)

This is the species called " *F. murmensis*" or " *moormensis*" by Hodgson who states it to inhabit the Central Region of Nepal.

(38) FELIS AFFINIS, Gray.

The Jungle Cat.

(Synonymy in No. 1.)

Hathiban, ♀ 2 ; Bouzini, ♂ 1 ; Hazaria, 300′, ♀ 1.
Bankalwa Morang, ♂ 1 ; Hindalwa Morang, ♂ 1.
" Hodgson".

(*See* also Reports Nos. 3-7, 10-12, 15, 16, 18-20, 22, 24, 27, 28.)

This is Hodgson's *Lynchus erythrotis* " apparently identical with *F. chaus*, Auct". Generally distributed throughout Nepal. (*Hodgson*).

(39) FELIS TORQUATA, F. Cuv.

The Waved Cat.

1826. *Felis torquata*, F. Cuvier, Hist. Nat. Mamm. pl. 126.
1837. *Felis inconspicua*, Gray, Charlesworth's Mag. N. H., i., p. 577.
? *Felis huttoni*, Blyth, J. A. S. B., xv., p. 109.

The type locality of this species is stated to be Nepal, where according to F. Cuvier it was obtained by Alfred Duvaucel. Hodgson makes no reference to the species.

(40) VIVERRA ZIBETHA, Linn.

The Large Indian Civet.

(Synonymy in No. 14.)

Chalna-Khel, ♀ 1 ; Hindalwa Morang, ♂ 1 ; Bankalwa, ♀ 2.
" Hodgson".

(*See* also Reports Nos. 17, 20, 23, 25-28.)

Generally distributed over Nepal, according to Hodgson, who thought there were two species, which he named " *melanurus*" and "*civettoides*" without publishing descriptions.

" Vernacular name :—*Nit Biralloo* (Pahari). In Patherghatta and Morang this seems to be most common and is very destructive to poultry". —*N.A.B.*

(41) VIVERRICULA MALACCENSIS, Gmel.

The Small Indian Civet

(Synonymy in No. 3.)

" Hodgson".

(*See* also Reports Nos. 5, 7, 10-13, 15-20, 22, 24, 27, 28.)

This animal is restricted in Nepal to the Tarai, according to Hodgson, who thought there were two species. The range as known to him extended along the Tarai from the Sutlej to the Tista.

(42) PRIONODON PARDICOLOR, Hodgs.

The Indian Tiger Cat.

(Synonymy in No. 23.)

" Hodgson".

(*See* also Report No. 25.)

This species, according to Hodgson, inhabits the Central and Northern hilly regions of Nepal. He sent specimens home first in November 1841.

(43) PARADOXURUS CROSSI, Gray.

The Northern Manoori.

1832. *Paradoxurus crossi*, Gray, P. Z. S., p. 66; Wroughton, J. B. N. H. S., xxv., p. 50.
1836. *Paradoxurus hirsutus*, Hodgson, As. Res. xix., p. 72.
1864. *Paradoxurus nigripes*, Gray, P. Z. S., p. 635.
1889. *Paradoxurus hermaphroditus*, (in part) Blanford, Mamm. 52.

" Hodgson".

In Nepal, restricted to the Tarai (*Hodgson*).

(44) PAGUMA GRAYI, Benn.

The Himalayan Palm Civet.

(Synonymy in No. 15.)

Thankot, ♂ 2.

" Hodgson". " Scully" (Ind. Mus.).

Inhabits the Central Region of Nepal. (*Hodgson*),

(45) HERPESTES AUROPUNCTATUS, Hodgs.

The Small Indian Mongoose.

(Synonymy in No. 27.)

Hathiban, ♂ 2, ♀ 1.

" Hodgson" Indian Mus. Collector 1872. "Scully" (Ind. Mus.).

Inhabits the Central Region of Nepal.

(46) HERPESTES NEPALENSIS, Gray.

The Nepal Mongoose.

(Synonymy in No. 19.)

Godaveri, 7,000′ ♂ 2, ♀ 1, unsexed 1.

(*See* also Report No. 27.)

These specimens appear to be indistinguishable from *H. nepalensis*, differing from *auropunctatus* in the much finer ticking and darker general colour of the coat. It is of interest to get positive evidence of the presence of this species in Nepal in view of the doubts as to its occurrence there held by Wroughton (J. B. N. H. S., xxv., p. 68).

(47) HERPESTES EDWARDSI, Geoff.

The Common Indian Mongoose.

(Synonymy in No. 1, under *Mungos mungo.*)

"Hodgson".

This is "*Herpestes* vel *Mangusta nyula*" of Hodgson who states that in Nepal it is restricted to the Tarai.

(48) HERPESTES URVA, Hodgs.

The Crab-eating Mongoose.

(Synonymy in No. 23.)

" Hodgson".

Inhabits the Lower and Central hilly regions of Nepal (Hodgson.)

(49) Canis indicus, Hodgs.

The Jackal.

(Synonymy in No. 1 under *C. aureus.*)

Nagarkot, 8,000′ ♀ 1; Katmandu 8,000′, unsexed 1.
Hathiban, ♂ 1; Bankalwa Morang, ♂ 2, ♂ 1.
"Hodgson". "Scully" (Ind. Mus.).

(*See* also Reports Nos. 14-16, 19, 20, 22, 25, 27, 28.)

Hodgson states that the Jackal is generally distributed over Nepal; but in a M.S. note he adds that it is "rare in Hills, common in the great populous valley of Nepal proper, seldom seen elsewhere in Hills".

"The Jackal is not common in Pathergatta."—*N. A. B.*

(50) Cuon dukhunensis, Sykes.

The Indian Wild Dog.

(Synonymy in No. 2.)

Sipari, ♂ 1, juv.
"Hodgson".

(*See* also Reports Nos. 4, 7, 11, 15.)

Distributed over the Lower, Central and Northern hilly regions of Nepal (*Hodgson*).

"Vernacular name:—*Bhonso* (Pahari); *Farppa* (Bhotia). Very rare in Nepal".—*N.A.B.*

(51) Vulpes bengalensis, Shaw.

The Indian Fox.

(Synonymy in No. 1.)

Hindalwa, ♀ 2.
"Hodgson". "Scully" (Ind. Mus.).

(*See* also Reports Nos. 3, 5, 7, 10, 15, 19, 24.)

According to Hodgson this Fox in Nepal is confined to the Tarai whence he sent specimens home in November 1841.

Two specimens collected by Scully in the valley of Nepal are however listed in the Cat. Ind. Mus. (ii., p. 272), a male from Katmandu and a female from Ranijangal.

"Vernacular names:—*Laddia* (Mallaha); *Feuro* (Pahari).

"This fox is very common in Morang, and can be got around the villages. It is easy to take them in their holes at noon. At one place I found ten holes, but only two foxes were in these. Very shy. Traps baited with meat, set near their holes, failed to catch them."—*N. A. B.*

(52) Vulpes montana, Pearson.

The Hill Fox.

(Synonymy in No. 15.)

Hodgson records this species as inhabiting the Central and Northern hilly regions of Nepal. This is not improbable, for this fox was obtained by the Mammal Survey in Sikkim at heights above 10,000′ (See Report No. 23) and it has of course long been known from the countries to the west and north of Nepal.

(53) CHARRONIA FLAVIGULA, Bodd.

The Northern Indian Marten.

(Synonymy in No. 15 under *Martes flavigula.*)
Nagarkot, 8,000′, ♂ 2, ♀ 1; Godaveru, 7,000′, ♀ 1.
" Hodgson." " Scully " (Ind. Mus:—" Nepal " and "Nimbota," Nepal.)

(*See* also Reports Nos. 15, 20, 23, 25, 27, 28).

Pocock (A. M. N. H. (9) i., p. 308, 1918) has recently established a special genus for this species of Marten, for which Gray's generic name *Charronia* is available.

According to Hodgson it inhabits only the Central Region of Nepal.

(54) MUSTELA SUBHEMACHALANA, Hodgs.

The Himalayan Weasel.

(Synonymy in No. 23.)

" Hodgson."

Inhabits the Central and Northern regions of Nepal. (*Hodgson.*)

(55) MUSTELA CANIGULA, Hodgs.

The White-nosed Weasel.

1842. *Mustela canigula*, Hodgson, J. A. S. B., xi., p. 279; Blanford Mamm. No. 83.
1843. *Mustela hodgsoni*, Gray, A.M.N.H., xi., p. 118.
" Hodgson."

Although described from Lhasa, Tibet, there is reason to believe that Hodgson subsequently became acquainted with Nepalese specimens of this animal. In some copies (1) of his " Classified Catalogue of the Mammals of Nepal " (J.A.S.B., x., p. 907) with M.S. corrections by Hodgson himself down to the end of 1843, Hodgson has inserted the species in his list. The habitat recorded in his unpublished drawings (Vol. 1, p. 61, Zool. Soc.) reads " Northern region of Himalayas and Tibet " and on the back of the drawing he mentions " Skin from the Kachar, February". The species may therefore be given a provisional place in the present list.

(56) MUSTELA KATHIAH, Hodgs.

The Yellow-bellied Weasel.

(Synonymy in No. 15.)

" Hodgson."

(*See* also Report No. 26.)

The species was obtained by Hodgson from the Kachar of Nepal as early as July 1824.

Besides the species above enumerated Hodgson mentions in his Catalogue of 1841, a *Mustela calotis* inhabiting Central Nepal; this we are unable to identify. He also records *Mustela erminea* from Nepal, but as Blanford points out " the only specimen made over by him to the British Museum is a furrier's skin, said to have been brought from Tibet."

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(1) Formerly in the possession of Dr. Gray.

(57) MELOGALE NIPALENSIS, Hodgs.

The Brown Ferret Badger.

1836. *Gulo nipalensis,* Hodgson, J.A.S.B., v., p. 237 ; vi., p. 500.
1853. *Helictis nipalensis,* Gray, P.Z.S., 1853, p. 191 ; Blanford Mamm. No. 87.
"Hodgson."

Inhabits the "Lower region of mountains" of Nepal. (*Hodgson.*)

One of the original specimens was obtained from the "Banks of the Rapti."

In Wroughton's Summary, J.B.N.H.S., xxvi., p. 347, the locality "Dilkoosha, Cachar" doubtless refers to the Kachar of Nepal.

Thomas has recently pointed out (A.M.N.H. (9) ix., p. 193, 1922) that the Ferret Badgers hitherto placed in a single genus *Helictis* fall into three natural genera by the characters of the dentition and baculum. The present species belongs to the genus *Melogale,* Geoff., of which *personata* is the genotype; this includes the species with large teeth and bifid baculum, and ranges through the mainland area from Nepal to Cochin China and Java. The remarkable species found in North Borneo formerly called *Helictis everetti* with small teeth and bifid baculum is now referred to a new genus *Nasictis,* Thomas. *Helictis* is restricted by Thomas to *moschata* and its allies; these forms, inhabiting Assam, China from Canton to Shanghai, Hainan and Formosa, have small teeth and trifid baculum.

(58) MELLIVORA INDICA, Kerr.

The Indian Ratel.

(Synonymy in No. 3.)

"Hodgson."

(*See* also Report No. 19.)

Inhabits the lower hilly region of Nepal. (*Hodgson.*)

(59) LUTRA LUTRA NAIR, F. Cuv.

The Common Indian Otter.

1823. *Lutra nair,* F. Cuvier, Dict. Sc. Nat, xxvii., p. 247 ; Pondicherri, Hodgson, 1839.
1837. *Lutra indica,* Gray, Charlesworth's Mag. N.H., i., p. 580, Madras.
1839. *Lutra monticola,* Hodgson, Cat., p. 14.
1865. *Barangia nepalensis,* Gray, P.Z.S., 1865, p. 124.
"Hodgson."

This is the Indian representative of the Common Otter of Europe, and in previous reports has been noted as *L. lutra. Lutra nair* was originally described from Pondicherri, while Gray's *indica* was described from Madras. Hodgson recognised that one of the otters of the Tarai of Nepal was identical with that living in the plains of the peninsula ; but he thought that the corresponding form inhabiting the Lower and Central hilly regions of Nepal was distinct and he described it as a distinct species *L. monticola.* Pending the collection of further material in Nepal we must follow Pohle and relegate *monticola* to the synonymy of *nair.*

(60) LUTROGALE BARANG TARAYENSIS, Hodgs.

The Smooth Indian Otter.

1823. *Lutra barang*, F. Cuvier, Dict. Sc. Nat., Paris, xxvii., p. 46.
1839. *Lutra tarayensis*, Hodgson, J.A.S.B., viii., p. 319.
1865. *Lutra macrodus*, Gray, P.Z.S., 1865, p. 128.
1878. *Lutra ellioti*, Anderson, An. Zool. Res., p. 212.
"Hodgson."

In Nepal, according to Hodgson, this otter is restricted to the Tarai.

Pohle separates the smooth otters from true *Lutra* as a special subgenus for which he has revived Gray's name *Lutrogale*. An independent study of the group leads us, however, to give full generic rank to *Lutrogale*, and we are glad to find that this course has already been adopted by Pocock (P.Z.S., 1921, p. 542), for reasons very similar to our own.

L. b. tarayensis is the most widely spread form of the smooth otter, its range extending through Burma and the plains of India to the foot of the Himalayas. Pohle deserves great credit for having independently, and without access to the original material, arrived at true views as to the status and affinities of *L. tarayensis*. That it is a synonym of *macrodus* was also concluded by Thomas and Wroughton (J.B.N.S., xxvi., p. 48). As Pohle points out it cannot be regarded as more than subspecifically distinct from *L. barang*, Cuv., described from Sumatra.

The representative of *L. b. tarayensis* in the lower and central hilly regions of Nepal is according to Hodgson a distinct form, to which he gave the name *L. aurobrunnea*. Thomas was not able to distinguish the type skin (a young specimen in bad condition) from *tarayensis* and therefore relegated the name *aurobrunnea* to Synonymy.

Pohle describes a specimen in the Berlin Museum, with the doubtful locality "Hinter-indien?", which seems to agree with Hodgson's description and to differ rather conspicuously from *tarayensis*; and he therefore provisionally retains *aurobrunnea* as a distinct subspecies. It is to be hoped that efforts will be made to get a good series of otters of all kinds from both the Tarai and the hilly regions of Nepal, for, as is well known, Hodgson believed the hill forms to be quite distinct from those inhabiting the plains, recognizing in all six nominal forms as occurring within the State. In the absence of modern material it is impossible to arrive at any sound judgment as to this; we can only register our opinion that it is not improbable that Hodgson eventually will be found to be right in this as in so many other matters.

(61) AMBLONYX CINEREA, Illig.

The Clawless Otter.

(Synonymy in No. 11 under *Aonyx cinerea.*)

"Hodgson".

(See also Reports Nos. 15, 16, 20, 31.)

The Oriental clawless otters are beyond all doubt generically distinct from either of the African clawless genera *Aonyx* and *Paraonyx*; and for them *Amblonyx*, Rafinesque (Atlantic Journ. I, 1832, p. 62) is the earliest name. *Amblonyx* was described as a subgenus of *Lutra* for *L. concolor* the clawless otter of the Garo Hills.

In his monograph Pohle separates the Indian form (under Hodgson's name *indigitata*) from the true *cinerea*, described from Java, and inhabiting Sumatra, Borneo and the Malay Peninsula. It is quite possible that this distinction is justified, but on the material available we are quite unable to recognize the distinguishing characters, claimed by Pohle and we must therefore for the present continue to use *cinerea* as the specific name for the Indian species. The series representing true *cinerea* in the British Museum is a fairly long one ; but our Indian material is extremely poor, including not more than five good skulls to represent the whole of India and Assam. Much the same remark could be made about each of the other Indian otters and it is to be hoped that members of the Society will make efforts to get together a good set of otter skulls representing all species in all localities.

(62) AILURUS FULGENS, F. Cuv.

The Red Cat-Bear.

(Synonymy in No. 23.)

" Hodgson". " Scully ". (Ind. Mus. skin " Nepal").

Inhabits the Central and Northern region of Nepal and Tibet (*Hodgson*).

(63) URSUS ISABELLINUS, Horsf.

The Indian Brown Bear.

1827. *Ursus isabellinus*, Horsfield, Linn. Trans. xv., p. 322.
1889. *Ursus arctus*, Blanford (*nec arctos*, Linn.) Mammalia No. 97.
" Hodgson".

In Nepal restricted to the northern Region or Kachar. (*Hodgson*).

(64) SELENARCTOS THIBETANUS, F. Cuv.

The Himalayan Black Bear.

1824. *Ursus thibetanus*, F. Cuvier, Hist. Nat., Mamm. pl. 213 ; Jerdon.
1841. *Ursus torquatus*, Wagner, Schreb, Säugethiere Suppl. ii., p. 144 ; Blanford " Mammalia" No. 197.
1879. *Ursus gedrosianus*, Blanford, J. A. S. B., xlvi., p. 317.
1917. *Arcticonus thibetanus*, Pocock, Ann. Mag. N. H. (8) xxi, p. 129; "*Arcticonnus*" antedated by *Selenarctos*, Heude 1901—(*vide* Sowerby J. Mamm., 1, p. 216).
" Hodgson".

(See also Reports Nos. 14, 20.)

Blanford rejected Cuvier's specific name *thibetanus* because this animal occurs on the southern slopes of the Himalayas and not in Thibet ; that of course is technically an inadmissible objection to the use of the earlier name. Pocock in the course of his studies of the external characters of the bears has found good reason for separating *thibetanus* as a distinct genus for which he proposed the name *Arcticonus*. But more recently Sowerby has pointed out that *Arcticonus* is antedated by *Selenarctos*.

We would take this opportunity to point out that the material representing the Bears of the Indian Empire in the British Museum is very poor. It is to be hoped that efforts will be made to get a good series of skulls (at all events) together for the national collection. There are many questions relating to the characters and status of local races which in the absence of proper materials for comparison must remain unanswered.

(65) PETAURISTA NOBILIS, Gray.

The Himalayan Flying Squirrel.

(Synonymy in No. 23.)

" Hodgson".
Central Region of Nepal.

(66) PETAURISTA CANICEPS, Gray.

The Grey-headed Flying Squirrel.

1842. *Pteromys caniceps*, Gray, A. M. N. H. x., p. 262; Blanford Mamm. No. 231.
1844. *Pteromys senex*, Hodgson, J. A. S. B., xiii., p. 68.
1911. *Petaurista caniceps*, Wroughton, J. B. N. H. S., xx, p. 1019.
"Hodgson".
Central Region of Nepal. (*Hodgson*).

(67) PETAURISTA ALBIVENTER, Gray.

Hodgson's Flying Squirrel.

(Synonymy in No. 15.)

" Hodgson".
Ind. Mus. Collector 1871 (Cal. I. M. ii., p. 36. Katmandu).

Hodgson discovered four species of Flying Squirrel in Nepal, *viz.*, the three species of *Petaurista* named above and *Pteromys alboniger* mentioned below. He describes them collectively as inhabiting the Lower, Central and Northern hilly regions of Nepal but as being rare in the Lower hilly region.

As explained by Wroughton (J. B. N. H. S., xx., p. 1019) Gray's names for the three species of *Petaurista* have to be used as being earlier than those proposed by Hodgson, delay having unfortunately occurred in publishing the original descriptions drawn up by the latter naturalist.

(68) PTEROMYS (HYLOPETES) ALBONIGER, Hodgs.

The Particoloured Flying Squirrel.

(Synonymy in No. 23.)

Sipari, ♂ 1.
" Hodgson".

Inhabits the Central and Northern regions of Nepal. (*Hodgson.*)

" Vernacular names :—*Rajpanki* (pahari) ; *Pyampio* (Bhotia). These flying squirrels live in holes in trees. At certain seasons they come down to lower elevations and are said to be plentiful. They build nests of grass in holes ; and move about at sunset". N.A.B.

(69) RATUFA GIGANTEA GIGANTEA, McCl.

The Assam Giant Squirrel.

(Synonymy in No. 14.)

" Hodgson" (" *Sciurus macruroides.*").

(See also Reports Nos. 23, 26, 28.)

Inhabits the Lower region and deep valleys of Central Nepal. (Hodgson M.S.).

But in his printed Catalogue of 1841 Hodgson, speaking of this species together with " *Sciurus locria*" and *locroides*, says of them all " Habitat Lower Central and Northern Regions indifferently ".

(70) DREMOMYS LOKRIAH, Hodgs.

The Orange-bellied Himalayan Squirrel.

(Synonymy in No. 20.)

Hathiban, ♂ 1; Chalna-Khel, ♂ 1.

"Hodgson" "Scully".

(See also Reports Nos. 23, 26.)

Inhabits Central and Lower hilly regions of Nepal. (Hodgson M.S.)

"Vernacular name for this and *Tomeutes*:—*Lotorki* (Mallaha and Pahari). Squirrels are common throughout the forest. Live in holes in trees. When alarmed utter a loud cry, and lie flat along the branch of a tree".—*N.A.B.*

Four specimens were obtained by Scully, three from Sheopari Ridge in the Nepal Valley, and one from Sisagutu. (Cat. Calc. Mus. ii., 20.)

(71) TOMEUTES LOKROIDES, Hodgs.

The Hoary-bellied Himalayan Squirrel.

(Synonymy in Nos. 20 and 23.)

Nowakot, ♂ 1; Loharipavda, 8,000′, ♂ 3, ♀ 2; Sunachir, ♂ 1; Katmandu, 8,000′, ♀ 2; Hetwada, ♂ 1, ♀ 1; Hathiban, ♀ 1; Chalna-Khel, ♂ 1; Hazaria, 300′, ♂ 6, ♀ 1; Bankalwa, ♂ 2.

"Hodgson". "Scully" (Nowakot Dist.)

(*See* also Reports Nos. 23, 26-28.)

Generally distributed in Nepal (Hodgson; *see* under *Ratufa*).

(72) FUNAMBULUS PENNANTI, Wrought.

The Common Five-striped Squirrel.

(Synonymy in No. 1.)

Tribinia, ♂ 1, ♀ 1.

Not recorded by Hodgson; probably confined to the Tarai.

(73) MARMOTA HIMALAYANUS, Hodgs.

The Tibet Marmot.

(Synonymy in No. 23.)

"Hodgson".

Habitat Northern Region of Nepal and Tibet. (*Hodgson.*)

(74) TATERA INDICA, Hardw.

The Indian Gerbil.

(Synonymy in No. 1.)

Bairia, 300′, ♂ 1, ♀ 2; Hazaria, 300′, ♂ 1, ♀ 1.

Probably restricted to the Tarai in Nepal.

"Vernacular name :—*Hurma* (Mallaha). Very common at Patherghatta. The flesh is eaten by the Mallahas".—*N.A.B.*

(75) BANDICOTA NEMORIVAGA, Hodgs.

The Smaller Bandicoot.

1836. *Mus* (*Rattus*) *nemorivagus*, Hodgson, J.A.S.B., xv., p. 234; Ann. Mag. N.H., xv., p. 266, 1845.
1845. *Mus macropus*, Hodgson, A.M.N.H., xv., p. 266.
1891. *Nesocia nemorivaga* (in part), Blanford, Mammalia No. 297.

1908. *Bandicota nemorivaga*, Wroughton, J. B. N. H. S., xviii., p. 752.
"Hodgson".

Inhabits the Central and Northern Regions of Nepal so far as known. (*Hodgson.*)

(76) GUNOMYS BENGALENSIS, Gray and Hardw.

The Bengal Mole Rat.

(Synonymy in No. 19.)

Bairia, 300′, ♂ 1, ♀ 2; Hazaria, 300′, ♂ 1; Bankalwa Morang, ♂ 1, ♀ 1.

This species is probably restricted to the Tarai in Nepal.

(77) RATTUS RATTUS BRUNNEUSCULUS, Hodgson.

White-bellied House Rat of Nepal.

1845. *Mus brunneusculus*, Hodgson, A. M. N. H., xv., p. 267.
1922. *Rattus rattus brunneusculus*, Hinton, J. B. N. H. S., xxvii., p.1057;
Kakani, 7,000′, ♂ 1; Ramchie, 11,000′, ♀ 1, Sunachir, ♀ 1; Pattbhagan. 8,000′, ♀ 1; Nagarkot, 8,000′, ♂ 4, ♀ 8.
"Hodgson".

The specimens collected by the Survey show that Hodgson's "*Mus brunneusculus*" is a well marked subspecies of *Rattus rattus* confined to the elevated Central Valley of Nepal and the slopes of the surrounding mountains, and most closely related to *R. r. sikkimensis.*

(78) RATTUS RATTUS BRUNNEUS, Hodgson.

The Nepalese House Rat.

1845. *Mus brunneus*, Hodgson, A. M. N. H., xv., p. 266.
1922. *Rattus rattus brunneus*, Hinton, J. B. N. H. S., xxviii., p. 1058.
Typical specimens:—Ferping, ♀ 5; Hatiban, ♀ 7; Godaveru, ♀ 2; Chalna-Khel, ♀ 1; Katmandu, 8,000′, ♂ 1.
White-bellied variety:—Changoo, ♂ 2, ♀ 5.
"Hodgson".

This remarkable rat (confined to the Central Valley and hilly region of Nepal) was believed by Hodgson and all subsequent writers to be nearly related to, or identical with, the Common Rat of Europe (*R. norvegicus*= "*decumanus*"), a species not otherwise known to occur in India, except as an introduced animal in the neighbourhood of the great ports. The material now collected by the Mammal Survey in Nepal enables us to prove that *brunneus* is a peculiar development from *R. rattus* and that its resemblance to *R. norvegicus* is purely superficial. The specimen (now B. M. No.) mentioned by Horsfield (Cat. Mamm. Mus. E. India Co., London 1851, p. 161) in connection with "*Mus arboreus* Buchanan-Hamilton" proves on examination to be one of Hodgson's specimens of *brunneus* sent by Hodgson as a gift to Sir W. Eliot, who considered it to be identical with his *Mus flavescens.*

(79) RATTUS RATTUS ARBOREUS, Buch-Hamilton.

The Bengal Tree Rat.

1851. *Mus arboreus*, Buchanan-Hamilton Horsfield, Cat. Mamm. Mus. E. India Co., London, p. 161.
1918. *Rattus rattus arboreus*, Hinton, J. B. N. H. S., xxvi., p. 74.

These specimens, agreeing closely with the material from Bengal and Orissa, show that the range of the present subspecies extends into the Nepal Tarai.

(80) Rattus rattus rufescens, Gray.

The Common Indian Rat.

(Synonymy in No. 1.)

Bairia, ♂ 1; Hazaria, 3,000′, ♂ 4, ♀ 4.

These specimens from the Nepal Tarai are perfectly typical examples of "*Mus rufescens*, Gray" in the strictest sense. It is of interest to note that none of the various House Rats found in Nepal, whether in the Tarai or in the Central Valley and Hills, shows the slightest trace of being affected by the introduction of rats from extraneous sources.

(81) Rattus rattoides, Hodgson.

The Nepal Hill Rat.

1845. *Mus rattoides*, Hodgson, Ann. Mag. N. H., xv., p. 267.
1914. *Epimys vicerex*, Wroughton (*nec.* Bonhote) Report No. 23. (Sikkim) J. B. N. H. S., xxiv., p. 489.

Katmandu, 8,000′, 1 unsexed; Nagarcot, ♂ 7, ♀ 7; Ferping, ♀ 3; Hathiban ♂ 2, ♀ 1; Thankot, ♂ 3; Changoo, ♂ 2; Sipari, ♂ 1; Ramchie, 11,000′, ♀ 1.

This is the rat which Hodgson thought represented the Black Rat of Europe (*R. rattus*) in Nepal. The material now collected by the Mammal Survey proves that this species is closely related to *R. vicerex* described from Simla, differing from it by its more modified skull, harsher coat, darkened colour and, usually, by its uniformly dusky tail. To *rattoides* must be referred also the specimens collected by the Survey in Sikkim, which were referred by Wroughton in Report No. 23 to *vicerex* "with some hesitation".

(82) Rattus nitidus, Hodgson.

The Nepal Shiny Rat.

(Synonymy in No. 15.)

Ferping, ♀ 1; Thankot, ♂ 1; Changoo, ♂ 1, ♀ 1.

This rat, of which long series were obtained by the Mammal Survey in Kumaon and Sikkim, appears to be rare in Nepal.

(83) Rattus fulvescens, Gray.

The Bicoloured Rat.

(Synonymy in No. 14.)

Hathiban, ♂ 3, ♀ 2; Chalna-Khel, ♂ 1, ♀ 2; Changoo, ♀ 1; Bouzini, ♂ 3.
"Hodgson".

"Trapped in a big rock, where there are old porcupine holes".—*N.A.B.*

(84) Rattus niveiventer, Hodgson.

The White-bellied Rat.

(Synonymy in No. 15.)

Thankot ♂ 1, ♀ 1, unsexed 1; Chalna-Khel, ♂ 2
"Hodgson".

"Inhabits the Central and Northern Region of Nepal" (*Hodgson*).

(85) MILLARDIA MELTADA, Gray.

The soft-furred Field Rat.

(Synonymy in No. 1.)

Bairia, 300', ♂ 1.

Probably restricted to the Tarai in Nepal.

(86) VANDELEURIA DUMETICOLA, Hodgson.

Hodgson's Tree Mouse.

(Synonymy in No. 16.)

" Hodgson". Indian Mus. Collector, 1870, Katmandu.
" Scully" (Indian Mus., Katmandu).

(*See* also Reports Nos. 23, 25, 26, 27, 28.)

Central and Northern Nepal. (*Hodgson.*)

(87) MUS DUBIUS, Hodgson.

The Nepal House Mouse.

(Synonymy in No. 15.)

" Hodgson".

(*See* also Reports Nos. 5, 6, 8—16, 18—20, 22, 23, 26, 27, 28, 30, 31, and 34, under *manei* and *urbanus*.

(88) LEGGADA CERVICOLOR, Hodgson.

The Nepal Field Mouse.

1845. *Mus cervicolor*, Hodgson, A. M. N. H., xv., p. 268.
1845. *Mus strophiatus*, Hodgson loc. cit.
Bouzini, ♀ 2 ; Sipari, ♂ 1, ♀ 1.
" Hodgson".

The four specimens collected by Baptista agree perfectly in outward appearance with the lectotype and lectoparatype of Hodgson's " *Mus cervicolor*" as well as with the type of his "*Mus strophiatus*". Unfortunately not one of the skulls is entire and beyond sufficing to prove that this animal is a *Leggada* and not a *Mus* they do not help us to form any idea as to the status of this nominal species. (*cf. Thomas* J. B. N. H.S., xxvi, p. 418, footnote.)

(89) GOLUNDA ELLIOTI, Gray.

The Indian Bush Rat.

(Synonymy in No. 1.)

" Hodgson".

Hodgson's *Mus myothrix* (A. M. N. H., xv., p. 267) is usually placed in the synonymy of *Golunda ellioti* ; but as Wroughton pointed out in the first Report the type is a mutilated flat skin and when the species is rediscovered it will probably turn out to be distinct from *ellioti*.

Inhabits Central and Northern Regions of Nepal (*Hodgson*).

" Tenants the woods solely, dwells in burrows under roots of trees, but not gregariously".—*Hodgson.*

(90) Cannomys badius, Hodgson.

The Bay Bamboo Rat.

(Synonymy in No. 20.)

Sunachir, ♂ 1; Hazaria, 300′, ♀ 2.
"Hodgson".

(*See* also Reports Nos. 23, 25—27.)

Inhabits the Lower and Central hilly regions of Nepal. *Hodgson.*

"Vernacular names:—*Khuma* (Mallaha); *Hondrongi Moosa* (Pahari). "This rat lives under the roots of a tree. The burrow is large and can be recognized by the large quantity of earth thrown out in front of it. In winter the burrow is not so deep as in summer. The flesh is eaten by the Mallahas".—*N. A. B.*

(91) Acanthion leucurus, Sykes.

The Indian Porcupine.

(Synonymy in No. 1.)

"Hodgson".

While resident in Nepal Hodgson thought that all the porcupines of that country were referable to the present species which he called "*nipalensis*". That he had examples of *leucurus* before him in Nepal is proved by one of his drawings (Zool. Soc. M. S., Vol. i., p. 213) representing a full grown female, weighing 30 lbs., which was sent home by Hodgson in July 1837.

(92) Acanthion hodgsoni, Gray.

The Crestless Himalayan Porcupine.

(Synonymy in No. 27.)

Hathiban, ♂ 1.
"Hodgson". "Scully" (Ind. Mus.)

Hodgson first learnt to discriminate between this and the last-mentioned species during his residence in Darjiling, and the specimens upon which he based his "*Hystrix alophus*" were all obtained in Sikkim. In the description of *alophus* the habitat is given simply as the "Sub-Himalayan slopes". A few months before the publication of Hodgson's paper, Gray described his *Acanthion hodgsoni* basing it upon two specimens obtained by Hodgson in Nepal. Hodgson's name "*nipalensis*" is therefore, in part, a synonym of this species as well as of *leucorus.*

"This porcupine is not common at present (April), and it is very difficult to find its holes. I am told that in the middle of July it is frequently seen among cornbeans. I trapped it about two miles from camp, where there was a pair in a hole, but one escaped leaving its hind leg in a trap".—*N. A. B.*

(93) Lepus ruficaudatus, Geoff.

The Common Indian Hare.

(Synonymy in No. 15.)

Kakani, ♀ 1; Thankot, ♂ 1; Bouzini, ♂ 3, ♀ 4; Nagarkot, ♂ 1; Bairia, 300′, ♂ 1, ♀ 2; Bankalwa, ♂ 2.
"Hodgson". "Scully" (Ind. Mus. Thankot.)

(*See* also Reports Nos. 19, 21, 23, 26, 27.)

Generally distributed in Nepal. Hodgson (1841).

"Common near the bank of the Soonsori River. The villagers catch them in nets. Very common in Nepal".—*N. A. B.*

(94) LEPUS OIOSTOLUS, Hodgson.

The Woolly Hare.

1840. *Lepus oiostolus,* Hodgson, J. A. S. B., ix., p. 1186.

1842. *Lepus pallipes,* Hodgson, J. A. S. B., xi., p. 288. Blanford Mamm. No. 324.

"Hodgson".

Habitat—Northern region of Nepal and Tibet. (Hodgson, 1841.)

(95) OCHOTONA ROYLEI NIPALENSIS, Hodgson.

The Himalayan Mouse Hare.

(Synonymy in No. 15.)

Pattibhagan, 8,000′, ♂ 4, ♀ 2, unsexed 1.

"Hodgson".

Habitat—Northern Region of Nepal and Tibet. (Hodgson, 1841.)

As stated in describing the mammals from the Mount Everest expedition of 1921 (Thomas and Hinton, A. M. N. H. (9) ix., p. 184) *Ochotona roylei* is represented by three well marked subspecies in the Himalayan region, namely by the typical form living in Kumaon, by the somewhat greyer though not materially different "*O. r. wardi*" of Kashmir and Hazara on the west, and lastly by the present dark-coloured subspecies inhabiting Nepal on the east.

(96) BIBOS GAURUS, H. Smith.

The Gaur.

(Synonymy in No. 5.)

"Hodgson".

(*See* also Reports Nos. 6, 11.)

Restricted in the Nepal to the Tarai. (Hodgson, 1841.)

(97) POËPHAGUS GRUNNIENS, Linn.

The Yak.

1766. *Bos grunniens,* Linnæus, Syst. Nat. I., p. 99; Blanford, Mamm. No. 341.

1827. *Bospoëphagus,* H. Smith, Griffith's An. Kingd., iv., p. 404.

1843. *Poëphagus grunniens,* Gray, List Mamm. B. M., p. 153.

According to Hodgson this species inhabits the Northern region of Nepal as well as Tibet. It is also known to occur in the highlands of Sikkim and Ladak.

(98) BUBALIS BUBALIS MACROCEROS, Hodgson.

The Buffalo.

(For synonymy, *see* Lydekker Cat. Ungulates I, p. 41.)

"Hodgson".

The type locality of this subspecies is apparently Nepal, not Assam as stated by Lydekker.

In Nepal the Buffalo is restricted to the Tarai. (Hodgson, 1841.)

(99) Ovis ammon hodgsoni, Blyth.

The Argali.

(Synonymy in Lydekker Cat., Ungulates 1, p. 97.)
" Hodgson".

Inhabits the northern region of Nepal. (Hodgson, 1841.)

(100) Pseudoïs nahoor, Hodgson.

The Bharal.

1833. *Ovis nayaur*, Hodgson, As. Res. xviii., p. 135, name misprinted.
1834. *Ovis nahoor*, Hodgson, P. Z. S., 1834, p. 107, misprint corrected.
1840. *Ovis burrhel*, Blyth, P. Z. S. 1840, p. 67.
1846. *Pseudois nahoor*, Hodgson, J. A. S. B., xv., p. 343.
1843. *Ovis nahura*, Gray, List Mamm. B. M., p. 170; Blanford Mamm. No. 346.
" Hodgson".

Habitat—Northern Region of Nepal. (Hodgson, 1841.)

(101) Capra sibirica skyn, Wagner.

The Himalayan Ibex.

(Synonymy in Lydekker Cat. Ung. 1, p. 149.)

Found in the Northern Region of Nepal. (Hodgson, 1841.)

(102) Hemitragus jemlahicus, H. Smith.

The Tahr.

1827. *Capra jemlahica*, H. Smith, Griffith's An. King, iv., p. 308.
1833. *Capra jharal*, Hodgson, As. Res. xviii., p. 129.
1835. *Capra quadrimammis*, Hodgson, J. A. S. B., iv., p. 710.
1847. *Hemitragus jemlaicus*, Gray, Cat. Osteol. B. M., p. 60; Blanford " Mammalia" No. 350.
Godaveru, 7,000′, ♀ 1.
" Hodgson".

Inhabits the Northern Region of Nepal. (Hodgson, 1841.)

(103) Capricornis sumatraensis thar, Hodgson.

The Nepalese Serow.

(Synonymy in Lydekker Cat. Ung. 1, p. 193.)
"Hodgson".

Inhabits Central and Northern Regions of Nepal. (Hodgson.)

(104) Nemorhædus hodgsoni, Pocock.

The Brown Himalayan Goral.

1908. *Nemorhedus hodgsoni*, Pocock, P. Z. S., 1908, p. 195.
1913. *Nemorhœdus hodgsoni*, Lydekker, Cat., Hume Bequest. B.M., p. 26.
Ramchie, 11,000′, ♂ 1, ♀ 1.

Hodgson refers to this animal under the name *Nemorhœdus goral* and states that it inhabits Central and Northern Nepal.

(105) Tetraceros quadricornis, Blainv.

The Four-horned Antelope.

(Synonymy in No. 2.)
"Hodgson".
(*See* also Reports Nos. 5, 7.)

Restricted to the Tarai in Nepal. (*Hodgson.*)

(106) ANTILOPE CERVICAPRA, Linn.

The Blackbuck.

(Synonymy in No. 1.)

(*See* also Reports Nos. 5, 10, 11, 24.)

Restricted to the Tarai in Nepal. (*Hodgson.*)

(107) GAZELLA BENNETTI, Sykes.

The Indian Gazelle.

(Synonymy in No. 1.)

(*See* also Reports Nos. 3, 7, 10, 17, 24.)

Restricted to the Tarai in Nepal. (*Hodgson.*)

(108) MUNTIACUS VAGINALIS, Bodd.

The Bengal Rib-faced Deer.

(Synonymy in No. 2, under *aureus.*)

Ramchie, 11,000′, ♂ 3; Thunsi, ♀ 1; Thankot, ♂ 1; Nagarkot, 8,000′, ♂ 1, ♀ 2, juv. 1; Hathiban, ♂ 1, ♀ 1. "Nepal", ♂ 1.
" Hodgson".

(*See* also Reports Nos. 20, 23, 27.)

Found in the Tarai, Lower and Central Hilly Regions of Nepal (*Hodgson.*)
"Vernacular name :—*Mirga* (Pahari.)
Very common in Hathiban and Thankot."—*N. A. B.*

(109) AXIS AXIS, Erxl.

The Spotted Deer.

(Synonymy in No. 5.)

Hazaria, 300′, ♀ 1; Bairia, 300′, ♀ 1.
" Hodgson".

(*See* also Reports Nos. 6, 7, 11.)

Hodgson thought there were two forms of this deer in Nepal, a larger and a smaller; both confined to the Tarai.
"Very common in above localities".—*N.A.B.*

(110) HYELAPHUS PORCINUS, Zimm.

The Hog Deer.

1777. *Cervus porcinus,* Zimmermann, Spec. Zool. Geogr., p. 552; Blanford Mammalia No. 369.
1827. *Cervus pumilio,* Hamilton-Smith, Griffith's An. King. iv., p. 120.
1844. *Hyelaphus porcinus,* Sundevall. Kong. Vet. Ak. Handl. 1844, p. 181.
1852. *Axis oryzus,* Kelaart, Prod. Faun. Zeylan, p. 83.

Bankalwa, ♂ 1, ♀ 2; Hindalwa, ♂ 2.
"Hodgson".

Restricted to the Tarai in Nepal. (*Hodgson.*)
"Vernacular-name :—Logna (Pahari).
Very common at Bankalwa. Villagers catch them with a net".—*N.A.B.*

(111) RUSA UNICOLOR, Kerr.

The Sambar.

(Synonymy in No. 5.)

"Hodgson".

(*See* also Reports Nos. 11, 15, 17, 18, 22, 27.)

In Nepal most frequent in the Tarai but occurring rarely in the Lower Hilly Region. (*Hodgson.*)

Hodgson thought that this animal was represented by three distinct species in Nepal, *viz.*, his "*jaraya, nepalensis* and *heterocerus*".

(112) RUCERVUS DUVAUCELLI, Cuv.

The Barasingha.

1825. *Cervus duvaucelli*, Cuvier, Ossemens Foss., ed. 3, iv., p. 505.
" Hodgson".

Restricted to the Tarai in Nepal. (*Hodgson.*)

(113) CERVUS WALLICHI, Cuv.

The Shou.

1825. *Cervus wallichi*, Cuvier, Oss. Foss. ed. 3, iv., p. 504.
" Hodgson".

Inhabits Northern hilly region of Nepal. (Hodgson.)

(114) MOSCHUS MOSCHIFERUS, Linn.

The Musk Deer.

(Synonymy in No. 3.)

" Hodgson".

Inhabits the Northern hilly region of Nepal and Tibet. (*Hodgson*).
Hodgson thought there were three species of this genus in Nepal.

(115) MOSCHIOLA MEMINNA, Erxl.

The Indian Chevrotain or Mouse Deer.

" Hodgson".

(*See* also Reports Nos. 11, 13, 18.)

Found only in the Tarai. (Hodgson.)

(116) SUS CRISTATUS, Wagn.

The Indian Wild Boar.

(Synonymy in No. 5.)

Bankalwa, ♀ 1.
" Hodgson".

(*See* also Reports Nos. 8, 10, 11, 18, 20, 22, 27, 30.)

Hodgson thought there were two varieties of wild Boar in Nepal ; and he states that they are generally distributed in that country.
" Very common all over Morang and Patherghatta".—*N. A. B.*

(117) RHINOCEROS UNICORNIS, Linn.

The Great Indian Rhinoceros.

1758. *Rhinoceros unicornis*, Linnæus, Syst. Nat. ed. 10, Vol. i., p. 56; Blanford " Mammalia" No. 334.
1801. *Rhinoceros indicus*, Cuvier, Menag. Mus. Hist. Nat., 1801, p.

1830. *Rhinoceros asiaticus*, Blumenbach, Handb. Naturgesch., eds. 12, p. 107.
1867. *Rhinoceros stenocephalus*, Gray, P. Z. S., 1867, p. 1018.
" Hodgson".
(Ind. Mus. Sir E. Baring, 1875, and J. Anderson, 1880, " Nepal Tarai".)

Restricted to the Tarai in Nepal. (*Hodgson.*)

(118) ELEPHAS MAXIMUS, Linn.

The Indian Elephant.

1766. *Elephas maximus*, Linnæus, Syst. Nat., ed. 10, i., p. 48.
1803. *Elephas asiaticus*, Blumenbach, Handb. Naturgesch, ii., p. 403.
" Hodgson".

In Hodgson's opinion two varieties of Elephant occur in Nepal, his "*isodactylus*" and " *heterodactylus*".

Restricted to the Tarai.

(119) MANIS PENTADACTYLA, Linn.

The Eastern Pangolin.

1758. *Manis pentadactyla*, Linnæus. Syst. Nat., ed. 10, i., p. 36 ; Wroughton, J. B. N. H. S., xxvii., p. 313, 1920.
1836. *Manis aurita*, Hodgson, J. A. S. B., v., p. 234 ; Blanford Mamm. No. 400.
" Hodgson".

Generally distributed in Nepal. (*Hodgson.*)

In addition to those mentioned above many species have been added to the Nepal List by Blanford, Wroughton, or others, merely upon the basis of specimens in the Hodgson Collection inaccurately labelled "Nepal". A list of these species is given below. Some of them may occur in Nepal, but at present there is no definite evidence of such occurrence.

Species asserted to be from Nepal but in reality from other countries ;—

Name.	Type locality.
Barbastella darjelingensis, Hodgs.	Darjiling.
Plecotus homochrous, Hodgs.	Sikkim (probably).
Tupaia belangeri chinensis, And.	Sikkim (probably).
Soriculus caudatas, Horsf.	Darjiling.
Soriculus leucops, Horsf.	Darjiling.
Felis marmorata, Martin	Sikkim (probably).
Paradoxurus strictus, Horsf.	Sikkim (Wroughton, J. B. N. H. S., xxv., p. 51).
Vulpes ferrilatus, Hodgs.	Lhasa, Tibet.
Mustela strigidorsa, Gray	Sikkim.
Mustela temon, Hodgs.	Nepal. (But his type is probably from Sikkim.)
Arctonyx collaris, F. Cuvier	Sikkim.
Tamiops macclellandi, Horsf.	Sikkim (probably).
Caprolagus hispidus, Blyth	Sal Forest of Sikkim, 1847.
Ochotona curzoniæ, Hodgs.	Sikkim.
Equus kiang, Moorcroft	Tibet.

In conclusion we should wish to draw attention to the fact that a Collection of Mammals from the Ganduk Basins, *i.e.*, the region lying between Kumaon and Katmandu, would be of very great value.

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

(INCLUDING THOSE MET WITH IN THE HILL STATIONS OF THE BOMBAY PRESIDENCY.)

BY

T. R. BELL, C.I.E., I.F.S. (Retd.)

(Continued from page 793 of Vol. XXVII.)

PART XIX.

(With 3 text figures).

Family—HESPERIIDÆ—*continued.*

Subfamily (1) *CELÆNORRHINÆ.*

Imago.—The butterflies are of various sizes, mostly with large, white or yellowish, translucent spots on the fore wings, the underside of the hind wing often suffused with white, bluish-white or yellow or spotted profusely with little dots ; the hind wings also sometimes with the outer margin sinuate or angled. Swinhoe gives the following :—

"*Antennæ.*—Club of moderate thickness, often recurved, bent at right angles to the shaft in *Charmion, Daimio, Tagiades, Caprona* and *Odontoptilum* ; hooked in *Satarupa, Odina, Tapena, Darpa.*

Palpi.—Porrect ; third joint short, conical, often minute.

Hind tibiæ.—With two pairs of spurs.

Fore wing.—Vein 12 ending before end of cell usually ; discocellulars oblique or suberect ; vein 3 from near end of cell, 2 from before middle of cell, usually about one-fourth from base of wing ; cell less than two-thirds the length of wing ; no costal fold.

Hind wing.—The discocellulars and vein 5 usually very faint."

Egg.—This is dome-shaped ; sometimes slightly elongated, always ribbed longitudinally but the number of ribs very variable even in one genus ; sometimes (*Tagiades, Odontoptilum, Abaratha*) covered with hairs and scales from the end of the abdomen of butterfly ; variable in colour. Size medium-large for the butterflies.

Larva.—Of two types ; one with a very large, deeply bilobed head widest across vertex ; the other with a comparatively smaller, bilobed, rounded head. All feed upon dicotyledonous plants and are white (in *Tapena*), green or brown, never coloured ; some have a distinct white collar behind the head ; all except *Tapena* are covered with minute, star-topped hairs.

Pupa.—Stoutish ; a short snout to frons of head between the eyes ; a prominent spiracular expansion to spiracle of segment 2 (wanting in that of *Tapena*); the proboscis produced beyond ends of wings at least as far as hinder margin of segment 8, often to 11 (again excepting *Tapena*). The colour uniform (*Celænorrhinus, Tapena,* &c.) or variegated with black spots (*Abaratha, Odontoptilum*) : green: brown.

Habits.—All the butterflies rest with their wings horizontally outspread, the surface generally quite even but in *Tapena* and *Odontoptilum* it is slightly convex and bent down at ends ; they are never held erect over the back at any time except when being dried after emergence from the pupa. They rest either on the undersides of leaves, rocks, boulders (*Celænorrhinus, Daimio, Tagiades,* &c.), or somewhat indifferently on uppersides and undersides—although at night apparently all of them take up the latter position. They all have a rapid enough flight but do not, as a rule, fly any distance at a time and have the habit of returning again and again to the same place of rest if disturbed, or even ordinarily after taking a seemingly aimless flight. They all go to flowers and all frequent jungly, shady places: *Sarangesa*, *Coladenia*, *Abaratha*, *Odontoptilum* bask sometimes in the sunlight—probably why they rest often on the *tops* of leaves—while the others never seem to do so. The eggs are laid on the top of a leaf and always one at a time. The little larvæ that emerge therefrom always make a little cell by turning over a small triangular or roundish or oblong piece, cut from the edge or in the middle of the leaf, on to the top, leaving a small hinge; this "lid" is fixed down round the edges, the inside is coated with a carpet of silk that has the effect of making it concave by contraction and upon this bed they take up their abode until too large for it. Then a new cell is made. The larva lies with its back to the leaf-surface and invariably with its head turned round on its side when resting. It pupates in the cell it last occupies often enough, but frequently goes off and makes a specially well-constructed one somewhere else.

Genus 1.—CELÆNORRHINUS.

In *Lepidoptera indica*, vol. x, p. 2, Colonel Swinhoe gives the following diagnosis of this genus :—

"*Antennæ.*—Club moderately thick, short, recurved at apex.

Hind tibiæ.—With two pairs of spurs in the male; with a tuft of hairs attached near the proximal end.

Fore wing.—Vein 12 ends on costa at about opposite the end of cell; discocellulars suberect, the upper minute, the lower longer than the middle; vein 6 emitted from the junction of the upper and middle discocellular, 5 from that of the middle and lower; 3 from one-sixth before end of cell, 2 from one-fourth from base; the cell less than two-thirds the length of the costa; costa slightly and evenly arched; apex subacute; outer margin convex; in some species it is nearly as long as the hinder margin which is nearly straight but in many species the outer margin is shorter, making the wing proportionately longer; hinder angle obtuse.

Hind wing.—Vein 7 from one-fifth before upper end of cell; discocellulars faint, erect; 5 hardly visible; 3 from close to lower end of cell; 2 from about one-third before end; apex of the wing rounded, outer margin sinuous but fairly rounded."

Egg.—Dome-shaped; shining, with 47 or 48 fine, low, minutely-beaded meridional ridges or ribs from base to about half way to top. Colour greenish-white.

Larva.—Moderately stout, fattest about middle, somewhat before it, with the head large, black, deeply, broadly bilobed; the colour olive-green with thin skin; a dorsolateral and spiracular, thin longitudinal line; the whole larva depressed-looking; the minute hairs all star-topped or branched.

Pupa.—Some shade of dark red-brown, stoutest in middle, pointed at anal end (cremaster), the frons with a prominent, rounded-conical process; the proboscis produced free beyond wings as far at least as cremaster; spiracles of segment 2 with prominent ear-shaped or semicircular expansions.

Habits.—The butterfly rests with wings horizontally flat-outspread and always on the undersides of leaves, rocks, boulders, &c. Flight rapid, very quick, somewhat erratic, not sustained; returning to resting place in the underwood. Colour of wings some shade of brown, generally dark ; fore wing nearly always with a broad, transverse band of white or yellow, large, hyaline spots on the disc. Hind wings variegated with many smallish white or yellow spots, rarely immaculate. Eggs mostly laid on tops of leaf, always single. Larva makes a cell of a triangular piece cut out of the leaf, generally from edge, turned over on the top, densely coated with silk on the—then, when thus turned over —underside which, by contraction of silks, becomes concave. It lies on this, "lid", which it fixes down, with its back to leaf surface its head turned round on its side. Continues this mode of life until end, making new and larger cells as it grows ; sometimes pupating in the last made ; at other times between two leaves. Feeds always upon *Acanthaceæ.* The pupa is attached strongly by the tail and a loose body-band, attached by the middle to the roof of the cell by a single thread or rope ; the fixings of the cover of the cell are slight ; the pupa lies normally, not back downwards like the larva.

198. Celænorrhinus ambareesa, (Moore).—Pl. N. Figs. 85♂, 85a♀.—Male. *Upperside*: dark olive-brown tinged with ochreous, fading to a much lighter shade with age; the basal areas of both wings with ochreous and brown hairs extending on to disc of hind wing where they are long along inner edge of abdominal groove, much shorter along the inner margins of both wings, with the cilia chequered brown and ochreous-white. Fore wing with three conjoined, subapical, semihyaline white spots from near costa in interspaces 6, 7, 8, larger than usual in a slight curve outwards, with two more further out in interspaces 5, 6 ; a discal band consisting of a large quadrate spot excavated on its outer side in outer part of cell ; another somewhat similar spot below it in interspace 2, its upper inner end below middle of the other ; a small spot between the two, outside them in interspace 3 and an ochreous one on costa above first ; a small ochreous spot below vein 2 just at its origin,a second below it at outer angle of large one of interspace 2 and a third slightly inwards immediately below last in interspace 1 ; a submarginal series of disconnected, short, sometimes very inconspicuous, ochreous, lunular spots. Hind wing with three rows of ochreous spots, the inner spots of the basal row hidden by hairs. *Underside* : paler, the markings similar. Antennæ with the basal third of the club ochreous continued on to the upper part of shaft below, and the shafts spotted with ochreous spots on dorsal surface. Palpi white-ochreous along outer side, the colour continued round the eye to bottom of basal tuft of antenna ; head and body above and below concolorous with wings ; abdomen below with thin ochreous-white segmental bands.—Female. Like the male but with the antennæ perhaps less conspicuously marked. Expanse : up to 50mm.

The species is figured on coloured plate N, figures 85 and 85a, male and female respectively. The representations are not bad but the female is perhaps a little bit too light in colour as compared to the male.

Egg.—There is little difference between the egg of this species and that of the others ; there are some 56 meridions of the same style. It is laid generally on the upperside of leaves in open situations with full access to the sunlight.

Larva.—The egg-larva is black with a black head that already has slight lobes and it is shining all over. The black colour remains until the last stage practically as does the shining surface. The last stage is dull chocolate-brown ; the *shape* is exactly the same as that of the others of the genus ; the head large and divided into two widely, triangularly-separated, conical lobes ; the ventrum is always flattened from the habit the larva has of sitting close-pressed to the surface ; the prolegs and anal claspers are short with the shanks coloured like the body, the ancles short and rounded, subtended by a double fringe of stiff, white hairs, the feet one-lobed and rather straight, dusky and immaculate, like the ancles ; the true legs are rather short, shining rusty-brown ; the anal flap is large, flat, semielliptical, well outreaching the bases of anal claspers, fringed round the edge with some simple, 0.15 mm long, whitish hairs as well as, further forward, with the tiny star-shaped ones that cover the body ; this flap is also somewhat slightly thickened all round the edge and a little constricted at front margin laterally : it is really rather more semicircular otherwise than semielliptical ; segment 13 is about one-quarter the length of 14 and one-third the length of 12 ; segments 11 and 10 are a bit longer but 9 to practically 3 or 4 are about the same length as 12; segment 2 is shorter and shining-orange looking, brownish-orange and somewhat tumid across middle like a collar behind the large *head* which measures 4.5mm in width in the middle, narrowing downwards somewhat but very little upwards, about as high as broad, the vertex-sinus dividing it into two lobes, triangular and about one-seventh as deep as the total height, the lobes being conical and blunt-topped ; the surface of the head is rugose in a longitudinally-corrugated manner, the corrugations rather irregular-coalescent and there are also fairly numerous, appressed, tiny, white, thickened hairs hardly 0.05mm long; the colour of the head is nearly black, a very dusky, shining, reddish-brown; the true clypeus is triangular, equal-sided, the apex the tiniest bit rounded, the height equal to a little less than half the head ; the false clypeus is shaped like a gothic window, a thin strip at base outside the other, widely arched over its apex but only reaching slightly beyond half height of the head, the apex acute, not rounded ; labrum transverse, small, only a quarter as long as true clypeus, slightly curved ; ligula as long as labrum, twice as broad as it is long, transversely oblong, the sinus very shallow, triangular and wide, the colour black while the colour of the labrum is more dusky than black ; basal antennal joint dusky, third rusty ; mandibles black, large, of the block-type and with the cutting edges quite entire ; the eyes are arranged 1 to 4 in a very slight curve, all equispaced, coequal in size, the distance separating them hardly an eye-diameter, number 6 more than three times as far from 4 and in a straight line with 3, 4, number 5 behind making a more or less equilateral triangle with 4 and 6 ; all the eyes are deep-brown or black. *Surface* with the segments well defined, the usual five transverse folds on the hinder half of each, the dorsum of the anal flap somewhat uneven; the whole body covered, rather sparsely really, with tiny, pure white stars of 0.05 mm in diameter ; these are really tiny translucent hair-stems broadening out into a little cup at top and the edge of the cup set with eight tiny hairs; these star-hairs are considerably longer along the dorsoventral margin. *Spiracles* oval, slightly prominent, light orange, about ten to a segment-length, those of segment 12 slightly larger, those of segment 2 very much larger, rather less in length than twice the breadth. *Colour* uniform, rather-dusky chocolate-brown all over except on segment 2 which has a shining-orange collar and the shanks of prolegs which are shining-brown ; the rest dull, all sprinkled over with the minute white dots due to the star-hairs, even to the anal flap but not on collar of segment 2 ; the star-hairs are about 0.1mm apart : about, that is, two of their own diameters. L : 30 mm when really stretched ; B : 6 mm at middle.

When these larvæ become absolutely full-fed the colour changes to an olive-green, rather dull with a slight, very slight, rosey tinge about segments 2 and 3 and a darkish, pulsating band or line dorsally the whole length from segment 6 to 12. The L : still 30 mm; the B : nearer 7 mm. There were still larvæ going on the 8-12-1922 from egg-larvæ obtained at Gudehalli in the beginning of October, about the 9th to 12th of that month. Some larvæ that had been obtained then that were well grown, have turned and produced butterflies, the first having emerged on the 30th of November. So it is a slow-growing species.

Pupa.—This is stoutish although gracefully lengthened, somewhat club-shaped, claviform, in *shape*, if it were not for the shortish and squarish head-piece made by the prominent eyes with a slightly conically produced head-frons between them surmounted by a low, knob-like, somewhat upturned snout or protuberance; the shoulders are somewhat unusually, although only slightly and quite smoothly, prominent and there is a slight and somewhat wide constriction laterally of the lateral outline from segment 4 to segment 6 ; the thorax is very distinctly humped, prominent, smoothly-convex ; the anal end pointed, the proboscis produced free to nearly the end of the cremaster beyond the wings ; the cremaster itself long and bent down evenly ; the ventral outline gently convex ; the cremaster is easily twice as long as segment 12 if not slightly more, with a short broad-conical base (its anterior portion) elongated into a longer, more or less oblong piece that is bent down, furrowed strongly in the dorsal line, this furrow being continued on to the anterior, conical portion, this anterior portion separated from segment 13 by a transverse, deep furrow also, the surface of the cremaster roughened conspicuously, its extremity truncated narrowly and bearing a bunch of short, packed suspensory hooklets, its ventral portion solid; ventrally segment 14 is more extensive and is composed of the large, somewhat prominent clasper-scars which extend forwards, compressing segment 13 into a very narrow, transverse band; segment 13 is dorsally much longer than ventrally in the shape of a transverse plate, somewhat tumid at its anterior margin where it is also indented slightly in the dorsal line : it is not very much shorter than segment 12 but is inclined to the longitudinal axis of the pupa at a greater angle than 12 or 14; segment 11 is very nearly double the length of 13 (or 12) and has the front margin bevilled longly though the bevil-surface is only little inclined to the longitudinal axis, but it is characterised by being unusually sculptured; the bevil-surface is transversely finely but conspicuously parallel-ridged by twelve separate ridges running from the spiracular region on one side to that on the other, this surface thus is broadest in the dorsal region; segments 10 and 9 are about the same length as 11 and have the front bevils exactly similar ; the hinder bevils of 8, 9, 10 are equal in length to these front bevils and similarly inclined but are perfectly smooth, somewhat dull, membranous ; the anterior bevils of 11, 10 and 9 are sharply separated from the hinder horizontal segment-surface by a raised, thin ridge—the hindermost of the parallel series characterising them ; also : the amount of dorsal, horizontal segment-surface left between the hinder and front bevils on each segment is very narrow, about half only of the length of one of the bevils ; segment 8 is longer somewhat than 9, the bevils all included in both cases ; segment 7 is nearly as long as 8 + its bevil and 6 is practically the same ; 5 is equal to 4, both about half 7 ; the thorax is equal in length to 5+6+7 together and about equal to the breadth of the pupa at shoulders, its hinder margin is a strong curve nearing a quarter-circle, the curve meeting the wing-line which curves towards it in a deep, angularly-rounded angle of 90°, the front margin is perfectly and evenly transverse-straight, the thorax is highest about middle, its anterior slope about 30° inclination to the longitudinal axis of the body ; segment 2 is about one-fourth the length of thorax, about equal to one and a half times 4, has its front margin straight and is in the same plane as the front slope of thorax ; *head* has the vertex (counted as far as the knob on frons) slightly longer than segment 2 with the inclination forwards perhaps slightly steeper than that of 2 ; the frons is, as stated before, slightly prominent and has a still more prominent, rugose-surfaced, upturned knob in its middle and the whole frons, taken as a separate piece, is in a plane perpendicular to the axis of pupa ; the clypeus follows at the ventral base of frons, is of quite a respectable size, rather smaller than the spiracle-patch of segment 2, trapeze-shaped, narrowing, strongly and incurvedly, distad ; the ligula quite ventral, long-diamond-shaped, as long as clypeus but much narrower ; eyes prominent, semi-circular, the surface rugose with the crescent medial, broad and very highly-polished ; proboscis reaching to cremaster, free beyond the wings; forelegs reach half the length of wings, the mid legs about two-thirds, the antennæ just beyond mid legs, all these acutely pointed at extremities. *Surface* of pupa is shining and covered with short, golden hair except on wings, eye-crescent, legs, antennæ and proboscis, this hair not much longer than a spiracle-length anywhere, a fringe of single hairs overhanging hinder bevils of 8, 9, 10, slight tufts on abdominal segment ventrally on each side of extended proboscis ; otherwise the hairs sparse, in no wise hiding the colour, sculpture or anything else of pupa ; the wings very shallowly, obscurely transverse-corrugate, the antennæ cross-ridged besides ; head obscurely confused-corrugate with eyes rugose and also knob; segment 2, thorax and rest pitted in a pin-prick manner, each pit bearing one of the little hairs mentioned ; segments all well defined, the hinder margins of 5, 6, 7 slightly tumid ; the whole wings also slightly tumid. *Spiracles* of segment 2 are mere slits with a large, three-quarter-circle-shaped, brown-golden (according to lights) patch behind each on the surface of the thorax ; this patch slightly raised, disc-like, along its margin, facing out and forwards, very shallowly funnel-like sloping to the slits : it is as long as well over half the length of segment 2 and very nearly as broad ; the other spiracles small, about as long as one-seventh a segment-length or one-eighth, oval, twice as long as broad, very slightly raised, whitish. *Colour* of the pupa is a rather bright golden-rusty on wings and head, 2 and thorax, the abdomen lighter somewhat with the front bevils redder as well as the cremaster. L. 23 mm ; B. 6 at middle, very slightly less at shoulders, slightly over 4 mm across eyes ; cremaster about 1·25 mm, the head-knob much less.

Habits.—The eggs of this Skipper are nearly invariably laid upon the uppersides of leaves and generally towards the top of the plant, otherwise upon the tenderer ones ; rarely, by mistake probably, an egg may be deposited upon an under surface. The place chosen is invariably somewhere in the open ; the plants must be exposed to the open sky as, apparently, the sun is a necessity ; this conclusion being confirmed by the fact that no caterpillers are ever found during the heavy rain months in Kanara when there is practically no sunshine for more than a few hours at a stretch. The butterfly is never seen on the sea-coast itself although, in the immediate vicinity, within two or three miles, on the hills at 1,500′, it is always in evidence during the drier, sunnier weather in October and thenceforward until the next June and the break of the monsoon. So its habitat is evidently limited by both height and absence of heavy cover. The larva is always sluggish, lies hidden during the day in a cell made out of a triangular portion of the leaf cut from the edge and turned over on to the top surface and there fastened down firmly all round with plenty of silk, lined thickly inside with the same material and evidently meant to last for some time. And it does last too for several stages of larval growth ; it is used until the caterpillers positively can no longer fit into it. Another similar cell is then made. The little larva when it comes out of the egg is black ; the whitish, transverse, short lines appear in the second stage. The original cell of the egg-larva may be nearly round ; the whole thing being concave inside ; later cells are more oblong than those of other species ; the entrance is always next the narrow tongue connecting the cover to the leaf and is quite round and open, though only just sufficiently large for egress. Inside the larva lies on the lid or cover with its back downwards and always sits with its head turned round on its side, the body much contracted. It feeds in the early morning and evening and, probably, during the night, wandering in its later stages a little afield to do so but confining itself, in its first stage, to a circumscribed area near the entrance to the cell. When it is fully fed it turns to a pupa either in the last cell or wanders and makes a new one, often out of withered leaves near the ground or actually on the earth. This last cell it coats all over with silk but rather thinly,fixes a pad for its tail and a band across its middle which is anchored on both sides as well as to the roof. The pupa is attached strongly by the end of the cremaster; it does not seem to emit any sound when disturbed; neither does it move much. The butterfly emerges in the early morning as a rule and after about two months from the deposition of the egg; so that the growth of the larva is very slow. Larvæ of all sizes were found in the beginning of October, some of them in the penultimate stage, and the first butterfly came out on the 30th of November; so that the time would seem to be even longer than two months. The time spent in the pupa is about a month. The butterflies frequent the open places in jungle country, the tops of ridges and hills where the soil is superficial and the rocks crop out being preferred to anything else. They rest on the undersides of leaves, their wings horizontally outspread and, when disturbed, they fly quickly away but return again in a short time to the same perch. They prefer rocks and earthen banks really to leaves as resting places and are more often found sitting on the surface of overhanging boulders on projecting parts of earth-banks, always on the undersides where they are in the shade and not easily seen. The brown colouring of wings and body with the fore wing plentifully spotted with hyaline white windows make a most effective protective pattern against any rock or earth background. Few enemies would spot them resting except that a lizard might see one that happened to settle near its lurking place or a bird that chanced to be near might snap it up; a spider's web might, during flight, enmesh it and lead to its undoing but, otherwise, the insect must be very immune from capture. It generally flies backwards and forwards upon a short, beaten track and takes no prolonged excursions. The females are found flying above the tops of the foodplant in the sun occasionally and individuals may occasionally be seen basking on the upper sides of leaves similarly in the open, but that is not often. They visit flowers, however, but, even then, chiefly such as are amongst herbage under leaves and in the shade; chiefly, also, in the early part of the day round openings in the jungle, by the sides of footpaths and nallas where there are open bits. The foodplant of the larva is *Strobilanthes callosus*, Nees, a gregarious shrub of the hills that forms an undergrowth over patches of jungle sometimes miles in extent on the Western Ghats and elsewhere in South India from the Surat Dangs down. The insect has also been berd on *Dœdalacanthus roseus*, T. Anders. and *D. purpurascens*, T. Anders. in Kanara District of the Bombay Presidency. Swinhoe gives the habitat as "South India, Ceylon". He further states that the type came from Maungbhoom in Lower Bengal and that de Nicéville records it from Trichinopoli; that it is a common species in Southern India and he has taken many examples in Mahableshwar, Matheran and in and about Bombay and has it from Kanara; and that Hampson records it from the

Nilgiris, Evans from the Palni Hills. It is quite plentiful both in the Surat Dangs and in Khandesh District. The foodplant is locally known as Karvi in Kanara and there are quite a number of species of *Strobilanthes*. Some of these flower annually, others biennially, some every three years and others again only every five or every seven years when the plants die down completely. The flowers are large and conspicuous along the stems and are white, mauve, blue, or rose-coloured. There is no mistaking the plant when it is in flower.

199. Celænorrhinus leucocera, (*Kollar*).—Male. *Upperside*: dark, blackish-brown, the basal area of both wings clothed with greenish-ochreous hairs. Fore wing with three conjoined, semi-hyaline, white, subapical small spots in interspaces 6, 7, 8, with the two similarly small, well-separated spots outwardly below in interspaces 4, 5 ; a semi-hyaline, white, outwardly oblique discal band, composed of two large, conjoined, sub-quadrate spots, the upper one filling the width of cell near end, with a small spot, sometimes a twin spot, between its upper side and costa ; the lower spot, the larger, in interspace 2, protruding outwards, its inner side attached to the outer lower side of the upper ; a small, round spot close to its outer, upper corner in interspace 3 with another, slightly larger spot attached to its lower, outer corner in interspace 1 with, sometimes, a very small detached spot inwardly below it. Hind wing: with a medial and discal series of small, orange-ochreous spots, some of the discal series very obscure. *Underside*: paler, markings as on the upperside but there is an extra ochreous, small, round spot in the middle of cell in the hind wing and the hinder marginal space in the fore wing is pale. Antennæ with the shaft and club pure-white above, the tip of the club entirely white ; palpi grey, white at the sides and also below the eyes ; head, body above and below and the legs concolorous with the wings ; abdomen beneath with whitish segmental bands. Cilia of fore wing brown basally, white outwardly with small brown patches at the vein-ends ; of hind wing, checkered brown and white.—Female. Like the male on both sides, the two large spots of the discal band of the fore wing a little disconnected. Antennæ black, the tip with a white stripe on the underside. Cilia alternately white and brown.

The above is nearly word for word taken from Swinhoe's *Lepidoptera Indica* and was written comparing fresh specimens detail for detail. In all the Kanara specimens the small spot, sometimes a twin spot, on the fore wing above the large upper discal one is ochreous. On the hind wing there is always a basal series as well of indistinct ochreous spots. The hairs on the basal area of fore wing are all short, decumbent, bright ochreous ; those on the hind wing are longer, much longer, ochreous and brown and extend all along abdominal area and right out to middle of disc ; the inner margin of fore wing is fringed with hairs. The cilia of fore wing are all brown with a grey tinge only towards tornal angle. Expanse up to 50 mm.

It is a fact that these butterflies vary somewhat with the season both in the depth of the colour and in the clearness of the markings of the hind wing. It is a matter of food chiefly, the succulent, young leaves producing quicker growth resulting generally in smaller size on the whole and deeper colouring. The *Acanthaceæ* are practically all herbs or herb-like bushes that have definite seasons of extremely vigorous sprouting and growth with a leafless off-period when many of them die down altogether leaving a few individuals that retain their leaves in the damper situations, but, in that case, the foliage is comparatively hard and juiceless. From this it happens that the butterflies that are produced in the monsoon months beginning with the early showers of May in Kanara are always small in size and dark with the markings blurred or rather small. Towards the end of the monsoon, getting on for the cold weather the rain stops, no new shoots or leaves are produced and the larvæ take longer to reach their full size and maturity; resulting in imagines (perfect insects—butterflies) larger, lighter in colour and with larger hyaline markings and brighter spots. The cold weather caterpillar is, of course, as a rule, also larger too, although this is not so noticeable. Thus it happens that, in these *Celœnorrhinus*, the slow-growing larva produces a larger perfect insect very much lighter in tone of colour and with more ochreous markings on the hind wings. A starved larva of the monsoon season can, with care, be so reduced in size that the resulting butterfly will have some of the small hyaline spots absolutely undeveloped, the larger ones much reduced in size, the markings of the hind wings practically wanting altogether. If due care is not taken to give the caterpillar just enough food it will either die, refuse to pupate properly or produce a deformed butterfly.

Egg.—This is dome shaped like the others, the base only 0·75 mm in diameter, greenish in colour with a shining surface that is sculptured with exceedingly fine low meridional ribs from base to top where they lose themselves, some losing themselves before that by anastomosing with others; there are from 56 to 60 of these ribs and the surface between them is extremely minutely cellular in appearance. B : 1·3 mm. ; H : 0·9 mm.

The cells are hexagonal, widely flat-bottomed, the bottoms pitted, the diameter of cells 0·05 mm, the walls one-sixth of it; 0·9 mm. circular space on top without ribs, cellular only, 0·2 mm. in the middle of that again merely pitted—the micropyle-area or surface.

Larva.—Is very like that of *C. area.* in the shape and in the colouring and marking. The anal flap here is parabolic in shape, rather thickened round the margin and tending to truncation at the extremity, the surface very rough in the end three quarters with the minute, star-topped hairs which are here thickly disposed, the little pittings from which they rise (it is difficult to say whether they are pits or dots) dark brown in colour but very minute; segment 13 a short segment with waved margins, about ⅓rd the length of segment 12 or 14; segment 12 shorter than segment 11. Segment 2 smooth and opaquely greenish white, shining, for half its length behind from margin, this portion bordered behind by a black line or dark-brown line with a little subdorsal brown dot in front of it. The *head* is the same shape as that of *C. area.* and has the same sculpture but there are no appressed hairs as in that species; the colour here is also nearly black (very dark red-brown really), the labrum is the same colour as the rest and the ligula is lighter and glassy; the eyes are dark except the first (from top) and the last within the curve; the true clypeus is triangular and acute-apexed, the false clypeus (not visible in *area*) outside it is also triangular, the apex acute, the sides minutely waved, reaching the upper border of the face. The *spiracles* are small, slightly raised, white ovals, that of segment 12 and that of segment 2 larger. *Surface* of larva nearly dull, the skin translucent showing all the tracheæ through, covered with tiny little star-topped or thick-topped, white hairs all over which are, if anything, shorter than those in *area,* about equally densely disposed. *Colour* is a darker olive green than in *C. area* with a similar narrow dorsolateral and spiracular greenish-white band from end to end ; all hairs rising from minute white dots below the dorsolateral band but not above ; legs, or legs and belly greenish but lighter than dorsal parts. L: 29 mm when at rest with segments contracted ; B: 6 mm. There is a dark, dorsal, pulsating line.

The larva would be 35 mm easily when moving and stretched a bit and is uniformly larger than that of *C. area.*

Pupa.—The pupa is of similar shape to that of *C. area* but is longer and slighter compared to the breadth and is always golden red-brown in colour with the proboscis free from the end of the wings to often a bit beyond the very extremity of the cremaster (end of the pupa altogether). The pupa is thickest at middle, thinning slightly to the shoulders whence it decreases more rapidly, but gradually, to the head (instead of suddenly as in *area*), the head forming a transverse piece with parallel sides and a longer front which would be straight except for the frons being prominently rounded with a hemispherical, very bluntly pointed knob on its apex, this knob pointing up and forwards and being quite short, the eyes are large and prominent laterally as usual; the head-vertex, segment 2 and the front slope of thorax are all in the same plane which is inclined at about 30° to the longitudinal axis, segment 2 is a short segment, both its margins parallel to each other and, therefore, straight; thorax not long, not much humped, its hinder half slightly descending to hinder margin (very nearly parallel to longitudinal axis really), the hinder margin a semicircular curve (but slightly narrowed in apical part) meeting the wings in a very widely rounded angle of something less than 90°. The cremastral segment is a strong, downcurved triangular piece, broad at the base, narrowing towards the end where the sides are parallel for a bit and then diverge again shortly before the extremity which is slightly thickened and along which are arranged the tiny suspensory hooklets rather densely ; this cremaster has the extensor ridges along its borders prominent and bent down along the hinder margin laterally, the dorsal part being thus depressed, the whole segment separated from the very short, slightly swollen segment 13; ventrally the extensor ridges run back and down into the ventral, thick base of the segment where they curve widely round to include the anal clasper-scars. Segment 12 is only slightly shorter than segment 11. *Surface* of the pupa is shining and punctate minutely and somewhat distantly on the first three segments,minutely tuberculate (each tubercle bearing a short, red hair) on the abdominal segments where the hinder margins of segments 8 to 10 are broadly less shiny and smooth and gently bevilled, the opposing segment margins of 9 to 11 broadly also gently bevilled and minutely regularly lined or ridged parallel to the segment margins ; segment 4 has a smooth space in centre and the wings are irregularly aciculate-wrinkled ; each tubercle is surmounted by an erect, brown, fine hair ; the eyes are rugose and hirsute ; the wings have no hair on them ; the proboscis reaches slightly beyond the pupal end and is gently in-curved throughout its length. The *spiracles* of segment 2 are indicated by a large, ear-shaped, thickened surface lying on the anterior part of segment 3, slightly free from the surface along its curved hinder margin, gently shelving towards the margin along its whole length, about $\frac{1}{6}$ the length of the whole margin, golden-plush in colour, bounded along the margin by a slightly raised, very much darker ridge ; the other spiracles raised slightly, the colour of pupal surface where they are situated, with thin, central, white, oval slits or centres ; not large. *Colour* of pupa is a rather light golden red-brown, darker on wings and first three segments and on cremastral segment, the veins of wings light. L : 24 mm. B : 6mm.

The proboscis is not included in the above length ; it would make the length about 26 mm if it were. In lateral outline there is a gentle gradual constriction between centre of pupal length and the shoulders.

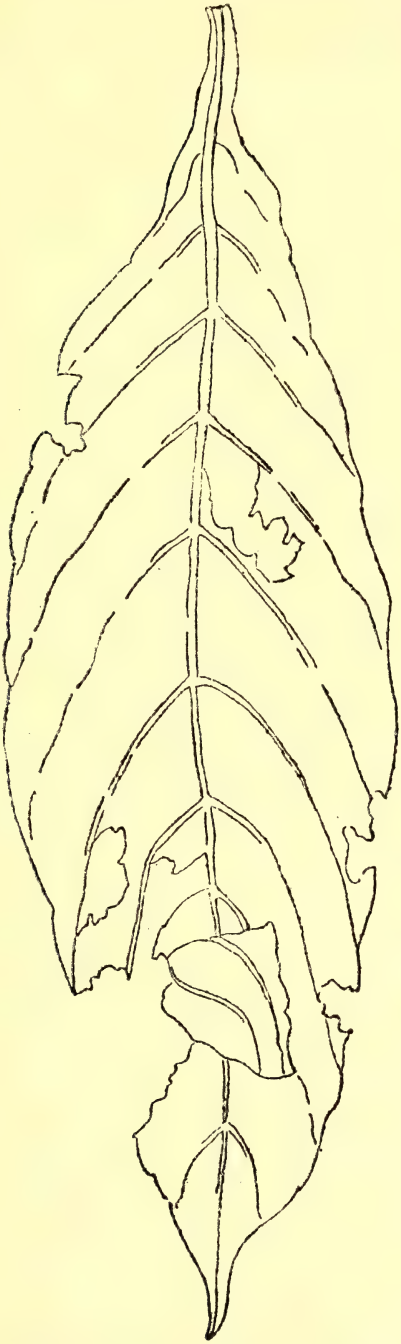

Fig. 1.—*Celænorrhinus leucocera :* cell of Larva.

Habits.—The egg is laid on the top or bottom of the leaf indifferently. The habits of the larva are the same as for *C. area* though the caterpillar is much more sluggish than that of that species ; it makes its cell in the same way (see marginal figure), lies in the same way with its head turned round on its side ; and lives, even when full grown, in a cell formed by a three-cornered bit of leaf turned over on to the top surface, the attachment of this cover being a quite thin strip and the inside is carpeted top and bottom with silk, rather irregular as to thickness. The imago rests with wide spread wings on the underside of leaves and is fond of shady places. It has a quick flight. The rather large, white spots on the fore wing against the black ground-colour show up wonderfully well in the shady jungles and help recognition. The ordinary foodplant of the larva is *Dœdalacanthus roseus,* T. Anders. ; others *Ecbolium Linneanum,* Kurz and *Strobilanthes callosus,* Nees (*Acanthaceæ*), a very common under shrub throughout the Western Ghats. Swinhoe gives the habitat of this species as India and Burma. "Fairly common all over India in the hill ranges ; Elwes records it from the Karen Hills, Elwes and deNicéville from Tavoy ; Davidson, Bell and Aitken bred it at Karwar ; Hampson records it from the Nilgiris ; we have it also from Kulu, Sikkim and the Khasia Hills. Our description and figures are from Kulu'' (Swinhoe, *Lepidoptera Indica,* vol. x, p. 14). Davidson and Bell caught many specimens, in the Sind Valley, Kashmir at a place called Gund.

200. Celænorrhinus area, (Plötz).—Male. *Upperside*: dark olive brown with ochreous setæ on the base of fore wing and brown and ochreous hairs on base of hind wing and along abdominal area. Fore wing with the usual five small, subapical, semihyaline dots or spots, the upper three joined together, the lower two—generally there is only one—minute ; the discal, semihyaline, outwardly-oblique band commencing with a small white spot on costa a little beyond the middle attached to a moderately-large, subquadrate spot with its outer edge indented, a well-separated, similar spot or patch in interspace 2, a small round spot attached to its upper, outer corner and another close to its outer, lower corner, this last nearly always absent in the male ; there is a largish spot towards middle of wing above the inner margin that is blacker than the ground colour. Hind wing.—Without markings. Cilia of both wings alternately black and white. *Underside*: as on the upperside, the entire surface of both fore and hind wings covered with minute, ochreous-grey scales. Antennæ on the underside, with all the club except the tip and the upper third of the shaft, pure white, the remainder of the shaft with pure white dots ; palpi with the inner half ochreous-grey marked with black, the outer or upper half blackish, white at the sides and below the eyes on the head ; body above and below and the legs concolorous with the wings. Female.—Like the male above and below but the spots in the fore wing are larger, the discal band, therefore, rather more continuous, the outer spot usually wedged into the junction of the two large subquadrate spots ; also, on the underside of the hind wing, there is an obscure, whitish dot at the end of the cell. Cilia of both wings as in the male. Expanse up to 50 mm. in the female ; the male somewhat smaller.

The above is again taken from Swinhoe in the *Lepidoptera Indica.* In Kanara specimens there are indistinct white or ochreous markings on the hind wing in both sexes both above and below and obscure blackish spots of rather large size. Also the outer spot between the two large, discal spots is never, in either sex, wedged into the angle between the outer lower corner of the upper and upper corner of the lower on the fore wing. The cilia of the fore wing are not checkered and there is only the greyish bit near tornal angle found in *leucocera.* The female, too, has a very distinct pair of large whitish marks on the underside of fore wing above tornal angle which is also traceable in males. The abdomen in both sexes is transversely banded with intersegmental, white bands. In Swinhoe's picture of the species he shows the fore wings quite correctly with the cilia uncheckered notwithstanding what he says in the text ; he also shows the abdominal ventral intersegmental bands. Indeed the only difference between Kanara specimens and his *figures* (not the text description) is that in them the undersides—and uppersides too as far as that goes, in consequence—of the hind wings are quite unmarked. In the Kanara insect there is always an indistinct ochreous cell spot and submarginal series of spots which are always more distinct on the underside, especially in the female where they are sometimes quite well defined and rather bright ochreous, being always greyish in the male and not so clear.

Egg.—Is dome-shaped, slightly constricted at base where the diameter is 0·09 mm. increasing about half way up to 1 mm. ; the top is somewhat flattened, circularly, in a space with a diameter of 0.15 mm. : the micropyle situated in the middle of it. Surface shining, minutely pitted and sculptured with 47 or 48 fine, low, minutely-beaded, meridional ribs from base to summit but, on the micropyle-surface, they disintegrate into a fine net-work. Colour greenish white with the micropyle-surface a little darker. B : 1 mm. ; H. 0.7 mm. ; the ribs are 0.05 mm. apart in the middle and about 0.02 mm. in width. Only about forty to fifty eggs are laid apparently.

Larva.—The larva is circular in transverse section, thickest in middle, fining down to each end, the anal flap rather longly semielliptical in shape or rather parabolical and long, overreaching the anal prolegs and generally free of the surface of the leaf, its dorsal slope slightly inclined to longitudinal axis of larva ; segment 13 longest in the dorsal line, shorter towards the lateral region, only about $\frac{1}{3}$ the length of segment 12 ; segment 2 narrow compared to the *head* which is large and nearly square though curving in towards mouth-cavity, deeply indented on vertex in the dorsal line, the bilobation thus produced being wide and triangular, the lobes being pronounced, the vertex of each being evenly and narrowly rounded but not in the least pointed ; the clypeus is triangular, the apex acute situated about the middle of the face ; the eyes are four in an even curve, the sixth more widely separated (the four are at equal distances from each other) and slightly displaced inwards, the fifth right inside the curve towards its centre ; the surface is irregularly honeycombed-rugose, covered with short, appressed, light hairs giving it a silky appearance though these hairs are quite widely separated enough to in no way obscure the surface-sculpture; the surface is shining ; the colour is rather dark, bright red-brown ; the labrum slightly lighter, the ligula small, of the same colour as head as well as the basal joint of antennæ, the second antennal joint lighter with a dark tip ; the mandibles dark brown as well as the eyes. The *surface* of body is dull, the skin transparent-looking and covered with minute, erect, white hairs all over fairly thickly, each hair being bi or trifurcated starwise at the end ; these hairs longest on the anal segment-margin ; the segments thinly creased parallel to the hinder margins for a short distance forwards and parallel to these margins. The *spiracles* whitish or very slightly soiled-whitish, oval, very slightly prominent and rather small ; those of segments 2, 12 larger. The *colour* is an olive-green, very light in shade, more green than olive with a thin white spiracular and dorsolateral, white band from end to end ; the hairy true legs and prolegs green; the ventrum green. L : 31 mm. ; B : 5·5 mm. at middle.

Segment 2 is glassy-smooth for more than half the length from front margin, the glassy space being separated from the posterior portion of the segment by a brownish, thin line. The egg-larva is very dusky in colour, often blackish with blackish head that is distinctly lobed.

Pupa.—The pupa is more or less circular in transverse section from segment 4 to 13, the thorax being considerably humped, the section is oval in that region, slightly flattened on ventrum, at segment 1 and 2 the section would be transversely oval ; the *shape* is pointed at anal end, squarely blunt at front end except for the frontal, round-topped, short, conical prominence ; the pupa is perhaps broadest at the slightly roundly prominent shoulders but very little broader than at middle, between which and the shoulders there is a gradually curved slight constriction ; segments 1 and 2 (the piece composing these) is suddenly narrower than the pupa at shoulders and is nearly square, the ventrum parallel to, the dorsum inclined at an angle of 40° to the longitudinal axis, the head-vertex being in that line, the frons perpendicular to the axis and its whole width included in the base of a conical, frontal, short, round-topped prominence from between the eyes forwards ; segment 2 is a narrow, parallel-sided piece, the thorax is long, prominent, highest at middle (which is the highest part of pupa) with the hinder margin a short, parabolic curve meeting the wings in a very widely rounded angle of less than 90°. The proboscis is free from the end of wings to the base of cremaster; the cremastral segment has a short, transverse base from the end of which proceeds the cremaster, triangular, long, slightly down-bent, with strong extensor ridges bordering it dorsally, the space between depressed ; ventrally also there are these ridges, but shorter before diverging in wide curves to embrace the scars of the anal prolegs. The *spiracles* of segment 2 are indicated by, each, a small, ear-like excrescence of parabolic shape, slightly longer than broad at base, lying from the common margin of segments 2 and 3, back on segment 3 from which its posterior margins stand quite free though only slightly; the other spiracles small, rather narrowly oval; white and slightly prominent. The *surface* of the pupa is shiny and covered, like the larva, with similar hairs which are only visible under the lens and are densest and longest on head : on the eyes and prominence. The *colour* is grass green, very glassy-shining on thorax, lighter green on head, opaquer yellowish green on abdomen ; the wings light green, cremaster glassy whitish green. L : 17 mm. ; B : 4.5 mm.

Habits.—The larva, after emerging from the egg, the shell of which it eats, makes a little cell on the upper surface of the young leaf by turning over a tiny triangular portion which it fixes down with silks, lining the inside with silk ; this process is repeated as it grows, the cell being renewed of a larger size on new leaves ; when full grown it places one leaf over the other and fastens them, lying between. It pupates in such a cell or in a dead leaf which withers and falls to the surface of the ground if not already there. The imago comes out in the usual time, about 7 days. The larva dislikes the light and is found on bushes under the shade of other trees in retired places where the air is not too dry. Here in Karwar they are mostly found in semi-evergreen jungles. The pupa is strongly attached by the tail and a body-band made in the usual way. The eggs are laid single and on the top of the leaf, young ones being nearly always chosen. The larva, when touched, raises its head over its back and opens its jaws ; it often lies with its head turned round on its side in the cell. The butterfly is very common in the Kanara District of Bombay where it is found in company with *C. leucocera* and is just as numerous in individuals. It has exactly the same habits. The foodplant of the larva is also the same, *Strobilanthes callosus*, Nees, (*Acanthaceæ*). The insect can, Colonel Swinhoe states, readily be separated from *C. spilothyrus*, (Felder) by its checkered *cilia* and he confines it altogether to South India giving Lanaoli, Mahableshwar, the Palni and Nilgiri hills as localities of capture. He says the type came from Calcutta. It will be seen, however, by what is written above, that the Kanara species has got the fore wing with the cilia uncheckered as in *spilothyrus* and has also, in the female, the pale spots on the underside of fore wing above tornal angle of that species (although here they are white instead of ochereous).

Genus 2.—DAIMIO.

"*Antennæ.*—With a moderately formed club, bent over at about a right angel to shaft.

Palpi.—Porrect, third joint short, obtusely conical.

Hind tibiæ.—With two pairs of spurs, a tuft of hairs attached to its proximal end.

Fore wing.—Vein 12 ends on the costa before end of cell; discocellulars suberect; vein 3 emitted a little before lower end of cell; 2 about one-fourth from base; cell less than two-thirds length of costa; costa evenly arched, outer margin oblique and convex about middle, apex subacute, hinder angle angular, hinder margin straight.

Hind wing.—Vein 7 from a little before upper end of cell; the discocellulars very faint and nearly erect; 5 hardly visible; 3 from a short distance before lower end of cell, 2 from one-third before end; costa highly arched at base, apex rounded, outer margin somewhat sinuous.

General colouring.—Black to blackish-brown, sometimes greyish with a broad, white, oblique, discal band bordered by black spots across both wings." (Swinhoe in *Lepidoptera Indica*, vol. x, p. 29).

201. Daimio milliana, *Swinh.*—Male. *Upperside*: Fore wing. Dark brownish-grey; five subapical, semihyaline, white spots, the upper four in an outwardly oblique curve from near costa and very close to each other, the fifth, inwardly below the fourth and a little separated from it; a central band of large, semi-hyaline, white spots, the upper one at the end of the cell, its outer side rounded, its inner side concave; a similar-sized, quadrate spot below it in interspace 2 before its middle, its inner, upper end nearly touching the lower, inner end of cell-spot; a larger, quadrate spot attached to its lower side extending half inwards and expanding somewhat on the hinder margin; with two prominent black spots, one above the other, on each side of this spot, the outer pair well within the white; a small subquadrate spot close to the base of interspace 3 outside but close to the junction of the two upper spots. Hind wing. With the base narrowly, the outer margin broadly, brownish-grey; the rest of the wing pure-white; a continuous whorl all round the wing, from base to abdominal fold, of black spots, one below the costa within the white space, the others on the inner edges of the basal and outer marginal bands, the upper four annular, the others linear; a smaller, black spot at lower end of cell. Cilia of both wings brownish-grey. *Underside* similar, the black spots, very prominent. Antennæ brown with the upper half of the club white; palpi with bright-ochreous hairs; top of head similarly coloured; thorax with some white hairs; abdomen with the base and tip brownish-grey, the middle portion white; on the underside: thorax with white hairs, the abdomen entirely white. Female.—Similar to male.

In the wet-season brood the male has both sides much darker than in the dry-season form (that described above) with the markings similar, the subapical spots in the fore wing larger and somewhat elongated. Expanse 45 mm.

Habitat.—Burma, Types in the B. M.

There are several examples of both sexes in the B. M. from the Shan States, Tilin Yaw and Pegu.

The above is taken from Swinhoe in *Lepidoptera Indica*, vol. x, p. 34, and it is curious that a single example of the insect should have been caught with a net in Kanara many years ago—in the mid 90s—on the crest of the Western Ghats in Kanara at a place of the name of Anshi in January '98. It looked like a moth, fluttering past overhead in the manner of a hypsid or zygænid. No others have ever come to notice and it is fairly certain none have been captured. The specimen was practically perfect except for a small chip out of one of the wings and was a female. It agrees in every detail with the above description. The top of the head, the collar, the palpi except the small third joint which is black and the pectus are bright ochreous—nearly orange but of a light shade ; the legs are all quite brown. The expanse is only 1·5 inch or 38 mm. At the time of capture we thought it was *Satarupa bhagava,* an insect of N. E. Bengal, Ranikhet, Sikkim, the Kasias to Burma. Colonel Swinhoe says that Betham caught *bhagava* in the Central Provinces. It would, therefore, be interesting to know whether Betham diagnosed *his* insect correctly or not.

Genus 3.—TAGIADES.

Antennæ.—With a slender club, the terminal portion rather long and bent at about a right angle.

Palpi.—Porrect, the third joint minute.

Hind tibiæ.—With two pairs of spurs and fringed.

Fore wing.—Vein 12 ending on costa well before the end of the cell; discocellulars suberect, the lower the longer; vein 3 from one-fifth before lower end of cell, 2 from one-fourth from the base, the median vein strongly arched between bases of 2 and 3 ; cell less than two-thirds length of costa ; costa arched, apex angular with outer margin convex, hinder angle obtuse and hinder margin nearly straight.

Hind wing.—Vein 7 from one-fifth before upper end of cell ; discocellulars and vein 5 very faint ; vein 3 from before lower end of cell, 2 at about one-third before end ; wing evenly rounded.

Quoted from Colonel Swinhoe in *Lepidoptera Indica.* He further divides the genus into two groups which he calls the *Japetus Group* and the *Menaka Group.* For present purposes they might be called the *Obscurus Group* and the *Litigiosa Group* ; in the former the underside of hind wings bluish-white, the upperside with a narrow white or bluish-white border ; in the latter with the undersides pure white or orange on outer half of hind wing with black spots on the white. The fore wings in both are blackish with hyaline spots.

Egg.—Dome shaped. Surface ribbed fairly coarsely from base up to near apex ; the height being to the breadth in the proportion of about 1 to 7. The colour is red or brown and the eggs are covered with waved, curled hairs from the abdomen of the butterfly. They are always laid on the top of the leaf.

Larva.—Fat, stoutest about segments 5, 6 ; the neck much narrower, the head very large compared to it, semicircular, the base being across the vertex where it is widely, curvedly emarginate dividing it into widely-separated, short though well-formed lobe-points that are, however, quite blunt. The anal end flattened, broad, rounded, the flap overreaching the anal clasper-bases ; the surface of body clothed all over with extremely minute branched hairs visible only under a powerful lens. The larva lies with the ventrum appressed to surface. It is some shade of olive-green, the skin thin and without longitudinal lines ; the head either black or dull orange.

Pupa.—Fairly stout with the shoulders rounded and about as broad at shoulders as at middle ; the front square, broad, segment 2 and head in a plane more or less perpendicular to the longitudinal axis of the pupa, the frons with a short, stout process ; the spiracles of segment 2 with prominent spiracular processes ; the anal end with the cremaster well-formed, bent down somewhat, its extensor-ridges well-formed ; the proboscis produced shortly beyond ends of wings; the colour light green or sullied greyish with large, enamel-white triangles laterally or with blackish dots.

Habits.—As said above, the eggs are laid singly on the tops of the leaves, a young one being always chosen. The egg-larva comes out by a hole eaten through the top and wanders a bit before going to the part of the leaf where the cell is to be made. This is a nearly always a broad-triangular piece cut from the edge and turned over on to the top where it is fastened down lightly by a corner, a hinge being left to keep connection with the leaf-surface, this hinge thin and including a veinlet to strengthen it. The mouth of cell or hole of ingress and egress at the hinge. Inside this "lid" lined with a carpet of silk upon which the larva lies back downwards towards the main leaf-surface. This method continued through life, a new and larger cell being made as required ; finally a large oval bit is turned over, always lightly fixed down by a silk or two, never all round: and the edge of the lid is scalloped along both edges rather largely. The larvæ sometimes lie over for months after finishing feeding. They often pupate within the cell last inhabited. The pupa has a strong tail-attachment and a loose body-band attached to the lid by a rope of silk—it lies with the back towards the lid, not the other way up as the larva does. The butterflies inhabit forest countries where the vegetation is damp, generally in the hills and fly about in the underwood or near the ground in shady places. They rest on the undersides of leaves and return to the same leaf, never flying far or for long. The flight is very quick, in jerks, up and down. The larvæ feed upon *Dioscoraceæ* or Yams which are supposed to be monocotyledonous botanically.

202. Tagiades litigiosa, *Möschler*.—Male. *Upperside :* quite black ; fading, however, after some months to dark-brown with the basal half of fore wing patchily darker ; inner margin of both wings shortly fringed with hair which is black on fore wing ; white on hind wing, the latter wing with longer hair on inner half of disc from base, brown at base, white beyond; the hind wing largely white in outer two-thirds. Fore wing. Five small (about 0·5 mm in diameter) semihyaline spots from near costa before apex in interspaces 4 to 8, the third in 6 outwards with the fourth and fifth in a strong outward curve ; another further in near base of interspace 3 with a seventh inwards and not far off in the upper part of interspace 2 ; a spot in the upper part of end of cell with a subcostal spot above it and, finally, one in the bottom of end of cell near the origin of vein 5 that is not always there ; the cell and basal third of wing below vein 2 is very obscurely darker than the ground-colour even in the fresh, black specimens where also a blackish spot at the base of interspace 2 and a discal series of black spots can be made out. The hind wing. The basal third black, this black running broadly round the apex to the middle of the outer margin after which it is continued as large subterminal, black spots four in number at the end of veins 4, 3, 2 and 1 ; two black spots, very obscure, embedded in the outer margin of the black, basal space and two more in the inner margin of the black, apical band, these latter two sometimes quite well-defined although never disconnected from the band ; the four submarginal black spots in continuation of these two subapical ones are sometimes disconnected, at other times more or less confluent. The cilia are white on the white portion of hind wing, black elsewhere on both wings except for a white shade above tornal angle of forewing. *Underside :* with the fore wing paler but otherwise the same as upperside. Hind wing.

As on upperside but with the black replaced by light blue suffusion below the costal black band ; the black spot in upper part much more distinct. Female—Similar to the male but the black spots on hind wing larger, the two on the inner side of the black, apical band not altogether included in that band. Antennæ black, the end of club above pinkish, below white extending on to the upper part of the shaft; palpi white below, blue in certain lights at end of white, black at ends and on top ; head black with white at front bases of antennæ; body and basal half of abdomen black, the distal half of abdomen and whole of underside and legs white. Expanse 40 mm.

Egg.—The egg is dome-shaped. The surface sculptured with 12 or 13 meridional ribs from base up, ending near the top ; these ribs about 0.05 mm in thickness by rather less in height ; the intervals between them 0.15 mm. not including any part of any rib; the general surface apparently minutely rugose, only moderately shining but so covered over with a sort of dirty-white, cerous (?) matter as to nearly obscure it—it looks like a minute moss : the top of the egg is bare of ribs in a circular space of 0.5 mm diameter, the ribs ending abruptly on its circumference, truncatedly ; this bare surface slightly convex, minutely, superficially cellular. The colour is, as far as ascertainable, a sort of light chocolate or medium brown. B : 0·9 mm ; H. 0·65 mm.

Larva.—Pl. II, fig. 30.—The body is limaciform in *shape*, fattest in the middle, (7 mm) fining gently backwards to segment 9, more rapidly afterwards to become 3·5 mm at the anterior margin of segment 14 ; forwards, at segment 3 the breadth is 5 mm, segment 2 is only 3·5 mm at front margin, the dorsum is convex more or less semicircularly in transverse section from spiracle to spiracle, the complete circle being interrupted from bases of legs and prolegs across ventrum because the body is there considerably flattened ; segment 14 is twice the length of 13, segment 13 being about 1·85 mm long ; segment 11 is longer, about 2·75 mm ; segment 12 equals 13 ; segment 14 is, therefore, about twice as broad (at front margin) as long : it is semicircular but looks semi-elliptical as it is convex transversely, the inclination of its dorsal line being slight, its edges somewhat thickened and there is a circular patch dorsally taking up the whole width at extreme end and about two-thirds of the length which is defined by a slightly impressed line from the rest of the segment-surface, the texture being also slightly different, the free edge of the segment, the flap that is, overreaches the anal claspers by a distance equalling the length of a clasper; these claspers are very short, their shanks cylindrical, stout, the ancle broadly rounded and hardly distinguishable from the shanks except that it has a fringe of short, light hairs along its base ; the prolegs similar to the claspers : they are all light greenish-white ; the true legs very short, also with short hairs, whitish ; there are some very short,whitish erect hairs also round the free edge of anal flap. The larva is, on the whole, a very fat, ventrally flattened looking thing thinning a good deal at ends ; segment 2 is white, shining, the *head* (see marginal figure) appearing a good deal broader than it : as a matter of fact the head is only 4 mm broad to the 3·5 mm of segment 2 ; this head is very widely heart-shaped, the vertex being the broad side, widely and shallowly emarginate in a gentle curve, this emargination affecting upper part of face also leaving each lobe with the apex somewhat conical in appearance and situated as far as possible from the dorsal line and slightly forwards of actual occiput ; the surface of head is irregularly, rather coarsely reticulate veined, the veins slightly raised, the whole shining, the only visible hairs being on the labrum, ligula and end of antennal end-joint—others ventrally on palpi,

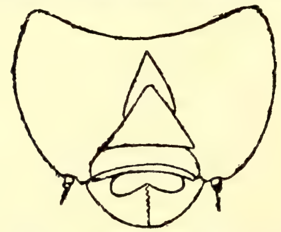

Fig. 2.—Head of *Tagiades atticus*, Möschler.

&c., none as long as half the true clypeus ; colour of the head is a rather light shining orange with a slight soiled tinge about it ; the true clypeus is an equilateral triangle with absolutely straight sides and perfectly-formed angles, about half the height of face ; the false clypeus starts very thin at base of true clypeus and reaches about one-third of true clypeus higher up face, its sides very slightly outward-curved from about half way up, its apical angle rounded narrowly ; both clypeuses have the surface as for the rest of the head ; the labrum slightly longer than a quarter of the true clypeus, its hinder margin straight, its front margin widely, superficially-emarginate, its width four times its length, and it is chitinized like the head-case and of the same dull-orange colour ; ligula the same length as labrum, not quite as broad, kidney-shaped, the sinus wide, shallow, its angle about 100° or more, triangular ; antennal basal joint whitish the third light-rusty ; mandibles shining black, very prominent and large, strong, the cutting edges, minute-toothed above, entire in the ventral moiety ; eyes arranged : 1 to 4 in a very gentle curve, all equidistant, number 6 four times as far below in a line with 3, 4, number 5 behind, four interspaces from number 6 and three interspaces from 4, all equal in size, all glassy, the pupils black. *Surface* of larva quite smooth, shining, with the segments all well marked but not in the slightest constricted, each segment with four transverse folds parallel to and from hinder margin forwards reaching half the length of segment so that each fold is equal to about one-eighth of a segment-length ; segment 2 quite smooth, white ; the hairs on legs, prolegs, free margin of segment 14 have been mentioned above—and there are others, excessively minute and not visible even except with difficulty under a strong lens in a good light : these hairs arising, one to each, from the yellow dots to be mentioned under " colour." *Spiracles* very small, about twelve to the segment-length, moderately broad ovals, slightly raised, white ; those of segment 12 very slightly larger ; those of segment 2 more than twice the size of the majority. *Colour* of body is whitish with a strong bluish tinge on segments 3, 5, 12, 13, 14 and an equally strong yellow colour on segments 6 to 11 ; the white mainly caused by numerous white dots, the yellow by numerous yellow dots, all these dots bearing each an excessively minute hair ; ventrum is bluish-white with a green tinge ; there is a 2mm. broad greenish, dorsal, pulsating band narrowing backwards, linear on 5, 4 and a pair of small, semicircular, yellow bodies visible at front margin of segment 10, one on each side of the dorsal line, that keep moving away from and towards each other slightly, sometimes quite meeting—these are the testes of the future moth : so this larva is a male. The L : 30 mm when at rest ; B : 7 mm at middle. Head 4 mm in diameter.

Pupa.—Pl. II, fig. 30 a.—This is in *shape* as follows : head quadrate, terminated by a strong conical beak ; thorax moderately convex ; abdomen stoutest in middle, the transverse section circular, ending in a down-curved, moderately-long cremaster ; the whole body robust, slightly constricted at segment 4, about as stout at shoulders as at middle. The *surface* is smooth, pitted all over with little brown-bottomed pits; segments all well defined. *Spiracles* oval, narrow, yellowish. *Colour* is a very light, translucent-looking green, the dorsal segment-margins edged with brown ; two large enamel-white, triangular, lateral marks on each side : one at the base of wing near the shoulder, the other, the larger of the two, has its apex at the highest point of wing, that is at tornal angle: the bases of these triangular, white marks are in a straight line if produced, distant from the ventral line one-third of the height of body—these triangles are longitudinally longer than transversely ; under the head, ventrally, are two symmetrically-situated, enamel-white patches and there is another triangular, much smaller patch behind the apex of the larger of the two lateral patches. More succinctly ; the white chalk-markings are : one small triangle, its base on hinder margin of segment 7 laterally, its ventral side curving over spiracle about a spiracle-length over it, reaching front margin where it impinges on wing, its dorsal side running thence diagonally up and backwards to other end of base which is nearly 1·5 mm long; another triangle, ventrally on the wing, one angle in the tornal angle of the same, one side, the posterior, running down and back along the outer margin half way to the apex of wing, the other side, the anterior, reaching nearly half way between base of wing and outer margin on vein 2, the ventral side of triangle parallel to ventral line; a third triangle of which the ventral side starts at base of vein 2 and runs forwards to just short of spiracle of segment 2 along antenna whence the anterior side runs back and up straight for the hinder margin of the thorax but stops half way—these three triangles outlined blackish thinly; the extreme angle of proboscis-base where it extends to eye and fore leg has a small white triangle in it and, finally, the frons under the frontal snout has a small, transverse white diamond on it on the common margin with clypeus, this diamond with both lateral corners connected linearly, shortly, with a much larger transversely-triangular patch that reaches up to the eye-crescent laterally and down inside of eye as far as base of proboscis longitudinally enclosing the clypeus, ligula and a small tubercle on each side of ligula—a little square area the colour of the pupa—on the two lateral sides, and anteriorly; the wings are, otherwise, quite immaculate; clypeus fuscous-brown, the tubercles on each side also, the white bordered black on each side; a fuscous, transverse line or narrow band across head over snout, another parallel across head between antennæ; all segment-margins brown, hinder margin of segments 2 and 10 broadest; a fuscous, dorsal double band on front half of thorax; wing margins between large, white triangular marks fuscous and some fuscous suffusion round margins of triangles: all pittings of surface finely rusty-margined; two fuscous dots on fore and mid tibiæ, discocellulars of wings brownish; a black splash above spiracle of segment 6, four black dots below and four above spiracle of segment 9; a black dorsolateral, central dot on some of the abdominal segments; the snout and eyes have also rusty-brown pits. Often the colour of a pupa, when formed in a cage or glass, is yellowish-white instead of green; it is always shining except on the powder-white, triangular patches. *Surface* of wings has the legs and other head-parts slightly prominent as well as the veins; every pit bears a tiny hair; there is a tuft of russet hairs where the prolegs have been situated on segments 9 and 10 besides other single hairs of similar size on sides of ventrum; the head, segment 2, thorax and abdomen are all pitted, and there is always a row of these pits along each segment-margin, the membranous hinder bevil-margin of segments 8, 9, 10 is quite smooth and pitless; the eyes are laterally prominent with the eye-crescent shining-glassy and nearly as broad as the antenna. *Spiracles* of segment 2 are indicated by a semicircular smallish sinus on front margin of segment 3 filled with densely-packed hairs, these hairs being longest behind, becoming quite short in front against the hinder margin of 2, the level of tops of these hairs thus sloping from behind forwards and looking like a velvety surface facing forwards: this surface assuming a grey to golden colour according as the light strikes it; the length of these spiracles of segment 2 is rather less than breadth of the adjacent antenna; other spiracles are from one-fourth to one-fifth as long as a segment-length and are four times as long as broad, narrow ovals of a slightly rusty colour with lighter centre, each placed in a very shallow, much broader depression. The *shape* of the pupa is, laterally considered, parallel-sided to shoulders, these a trifle prominent-rounded, the contour parallel-sided again as far as segment 8 after which it narrows very gently up to hinder margin of 10, then much more rapidly cone-wise, to end; dorsally the head-vertex and segment 2 together with front half of thorax rise at an angle of 45° to the longitudinal axis of body, the thorax then much less to become practically parallel to that axis in its posterior third, or sloping very slightly in the opposite direction, the apex of thorax being the highest point; from middle of segment

4 to hinder margin of 10 the dorsum is parallel to axis, afterwards inclined at 45° to cremaster which is down-curved ; the ventral line from snout to cremaster is very little convex ; segment 14 is practically all cremaster, the anterior half triangular, the distal half oblong in continuation, the oblong piece slightly dilated at extremity where it is set with many, densely-packed, minute shafts, all hooked and rusty-coloured : this cremaster twice as long as it is broad at front margin where it is depressed-emarginate triangularly and whitish, smooth, the rest of dorsal surface rusty, pitted : ventrally this cremaster is not hollowed out but segment 14 exists as a short disc, sloping ventrally, bordered by the extensor ridges from cremaster, the interval between them filled up by the scars of the anal claspers divided by an impressed, central line ; segment 13 is dorsally hardly half the length of cremaster, ventrally it is compressed by segment 14 into a linear strip with, in the middle, the rather small, circularly mouth-shaped male-organ tumidity ; segment 12 is a quarter as long again as 13 ; segment 11 very little longer than 12, the front half of it bevilled, its hinder margin very slightly tumid above segment 12 ; segment 10=9, slightly longer than 11 with front and hinder margins bevilled ; segment 8 again slightly longer ; segment 7=6=14 ; segment 5=4, very little more than half length of 7 ; thorax=segments 5 + 6 + 7 together, convex-tumid with the hinder margin nearly a semicirular curve meeting wings in a broadly-rounded, moderately-deep angle of about 90° ; segment 2 one-third the length of thorax, 4 × as broad as long, its anterior margin straight, its hinder margin curved backwards, the two meeting in a point under spiracles of 2 ; *head* with the vertex+frons twice as long as 2, the frons one-third length of whole, produced out into a short, cylindrical (shortly conical at base of course) beak, this beak porrect, not as long as segment 2, its extremity rounded ; clypeus ventral, just prominent, semicircular, a spiracle-length long by two spiracles wide ; ligula twice the length of clypeus between bases of proboscis-halves, in the form of an hour-glass coming to a point distally ; proboscis overreaches the ends of wings—here it is the hind wings which overreach the fore wings by quite a margin—by a little, the mid legs reach three-quarters the length, antennæ curving round their ends slightly, the fore legs reach to about the middle of wings. L : 19 mm ; B : 5 mm at middle, 4 mm at head.

Habits.—The egg is laid anywhere on the upperside of a young, tender leaf, on the very edge or well in the middle ; the little larva after three or four days, emerges through a hole near the top which it gnaws through from the inside widely and evenly ; it makes its initial meal of egg-shell, very often, however, not finishing it. Then it proceeds to the edge of the leaf and gnaws from it inwards between two nervures and about 4 mm distance until it reaches another nervure where it stops ; then proceeds to the edge again and starts another passage about 4 mm further on which it also gnaws inwards to within about 1 mm of the end of the first ; freeing, thus, a triangular piece of leaf, the apex of which is the narrow 1 mm hinge of the future cell, the base being the free edge of the leaf. This triangle it then turns over on to the top of the leaf, attaching it by one of the corners with silks (see marginal figure). It then proceeds to cover the whole bit over with a carpet of silks

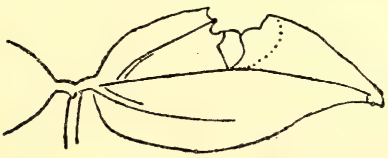

Fig. 3.—Cell of egg-larva of *Tagiades litigiosa*, Möschler.

which, by contraction, make it concave; upon this "lid" it takes up its abode, lying with its back towards the leaf-surface. The little larva is at first a light orange in colour with a disproportionately large-looking, shining-black, perfectly round head that looks altogether too big for its body; the skin is shining with the segments quite distinct and the transverse folds of the segments indicated but there is no sign of hairs, main ones or otherwise even under a strong 9 × lens. It is about 2·5 mm long, with a diameter of barely 0·5 mm. The colour soon changes to greenish after it commences eating vegetable food. After quitting the egg it often wanders considerably before commencing eating, that is before starting making its first cell; it has a shining-chitinized collar on segment 2, brown and transverse and linear. After it has finished its cell it marks off a small area by gnawing the cuticle of the upperside of the leaf from the hinge in a curve to the edge of leaf some distance beyond the gap left by the inturning of the lid and only feeds upon this area in its first stage. It rapidly increases to about 4 mm in length after a couple of meals. There are a few visible hairs along the dorso-ventral margin of body but they are extremely minute and only discernable against the light. It always returns to the cell after feeding. Sometimes it inhabits the original cell after it has undergone its first change for some time but, before entering upon the second, it invariably makes a larger new house which is much of the same shape. It is rather averse to wandering far from its cell in which it lies during the day time with its head turned round on its side. As it increases in size, it manufactures new cells; when full grown it turns over quite a large longly triangular piece of leaf which, in medium sized ones, often includes the tip and reaches well across the whole length or breadth of the leaf-surface. When touched it will open its jaws in a menacing way, lifting the fore part of the body and raising the head but never appears to actually bite. The larvæ always eat tender leaves at first but do not mind much later on how tough they may be provided they are fresh and green. The stages are of normal duration during the monsoon months when the plants are in full leaf, but, at the end of the rains, when they begin to lose their foliage, it may be otherwise. That may be after the third brood, perhaps even the fourth. Then the caterpillar does not at once change into the pupa after ceasing feeding but lies quiescent in its cell for quite a long period; perhaps even for months. It changes colour, becomes a translucent light-green and awaits its time. It may change its abode even once or twice—it does so as a rule; making new quarters in a withered leaf or some such place. When the time comes the larva becomes a pupa and the butterfly emerges in the orthodox ten days' time! There was a larva on the 14th of November 1890 that was full-grown. It eat sparingly until the 20th of the month and, after that date, it never moved from the cell until it became a pupa on the 10th of January following. Another larva became quiescent on the 1st of December and had not pupated by the 10th of January. One found outside in the quiescent state on the 25th of November did not pupate until the 10th of February, emerging as a butterfly on the 23rd in the evening. The pupa is formed in the cell and is fastened very strongly by the tail and a body-band ; the tail-fastening consists of a very strong, short rope of silk to the middle of which the cremastral hooklets are fixed by screwing motions ; the body-band is fastened to the surface of the leaf on both sides of the body and to the roof of the cell by a single thread from its middle straight over the dorsum of the chrysalis : the rope is composed of dozens of threads, the body string of some eight or ten, the ends of all of the single threads being spread out fan-wise in continuation of a net-work of threads carpeting the whole floor. The foodplant of the larva is always a dioscoreaceous plant, family *Discoreaceæ* or Yams. They are all climbers, creeping amongst the undergrowth and climbing up stems and tree-trunks. The leaves are mostly heart-shaped with pointed ends and longish stalks, always 3 or 5 nerved from the base. Two of the species are five-digitate. The commonest species in Kanara is *Dioscorea oppositifolia*, L. The flowers are all minute, about one-eighth of an inch in diameter, greenish, inconspicuous. The butterfly is a fast flier with the characteristic flight of a skipper, is generally found in the heavy jungles, flitting backwards and forwards on one beat, the only thing visible being the white hind wings as it goes past ; occasionally the attention is attracted to it by the *prr* of the wings as it goes past the ear. It settles, however, fairly frequently and generally in the same places, on the same leaves, sitting, with the wings horizontally outspread, mostly on the undersides. It visits flowers and also bird-droppings on leaf-surfaces ; but it does not bask in sunlight—in fact it avoids the sun, preferring shady places. It s a common species in Kanara from sea-level upwards in the jungles in the monsoon months. The distribution is throughout India, in Ceylon, Burma, Hongkong and Hainan according to Colonel Swinhoe (*Lep. ind.*, vol. x, p. 50). He says :—" A common species ; we cannot separate the southern form named *vajuna* by Frühstorfer from the northern examples. We have many examples from the Atarat Valley, Ceylon ; Orissa ; Kanara ; Sikkim ; the Khasia Hills and from many other localities ; Hannyngton records it from Kumaon, Watson from the Chin Hills and de Rhé-Philipe from Misuri. The type came from Sylhet."

This species was called *atticus* by Butler in his *Cat. Fabr. Lep. B. M.*, p. 283 (1869) and, in consequence, by Moore in 1881 (*Lep. Ceylon*, vol. I., p. 68), by Doherty in 1886 and so on up to the year 1908. It seems to have been named *litigiosa* by Möschler in 1878 ; Frühstorfer put it down as *menaka litigiosa* in 1910. Swinhoe separated it off as a good species.

There is a black and white representation of the larva and pupa on Plate II, figures 30 (larva) and 30a (pupa) which, although not very good, might serve as a sort of guide.

203- Tagiades obscurus, *Mabille.*—Male. *Upperside*: blackish-brown in fresh specimens, fading to brown, Fore wing. Always with the costa darker to beyond end of cell where it joins a band excurved round end of cell, incurved below it to middle of wing, then straight to inner margin; a large black spot in end of cell and another, subbasal, below vein 1; the outer margin also broadly darker. blacker; three very small, semihyaline, subapical dots in interspaces 6,7, 8 some of which may be absent; some brown hairs at base and a short fringe along inner margin, also brown. Hind wing. With the base darker as far as near middle of wing, the upper half of outside margin also darker and an indistinct curve of three or four postmedial darker spots showing through from underside; the outside margin in a 2mm. broad band suffused with blue-white as far as half way, or nearly half way, with the cilia white beyond this suffusion, sometimes with only the base of cilia white, the ends brown. Cilia of hind wing as well as fore wing otherwise concolourous with wings, sometimes with the usual light tips above tornal angle of fore wing. *Underside*: paler black or brown. Fore wing. Similar to upper side except that, sometimes, there is an extra semihyaline dot in interspace 4; palest along inner margin below the vein. Hind wing. The costa very broadly brown reaching down to vein 6 on outer margin; the rest of the wing white suffused with blue on base; a black spot in cell, a series of five postdiscal spots in a curve, the first, largest, in the middle of interspace 7 below costa, the others decreasing downwards in interspaces 6, 5, 4 and 3; sometimes the lower ones absent; outer margin with a diffuse, narrow, black, marginal band darkest and thickest towards anal angle. Female.—Similar to male; the bluish-suffused margin on outer margin of hind wing narrower. Antennae black in the female, in the male the club and shaft white below; palpi black above including third joint and tip of second, white below; head also black, the frons narrowly fringed whitish in front up to eyes; abdomen above concolourous with wings, the tip in the male touched by white, in the female with ochreous; underside of body and abdomen pure white as well as legs. Expanse 50 mm, the male always a bit less than the female.

Egg.—Dome-shaped, apex flattened, base shortly constricted with no basal band. Surface moderately shining with from 16-20 thin, meridional ribs, some six reaching micropyle-cell on apex, the others only to within 0·1mm. of it from base; cross-rayed between meridions, rays 0·025mm. apart; micropyle-cell hexagonal, 0·15mm. in diameter, its walls 0·025mm. thick by about half that high; meridions 0·025mm. high, 0·05mm. broad, separated by 0·1 mm. towards apex by 0·175mm. at base. Colour deep maroon-red with the meridions greyish. B : 0·9 mm.; H : 0·65 mm.

Larva.—In *shape* this larva is very like that of *Tagiades litigiosa.* It is, however, larger, the head is, perhaps, not quite so broad compared to the height and is always black instead of yellow; segment 2 is rosey white and the general colour is a kind of neutral greenish olive covered with white dots, the whole with a pinkish tinge; the head is larger (broader and higher) than segment 2: about the same diameter as segment 3; the body is transversely convex, the ventrum flat, the dorsal line gently curved, the slope of segments 11-14 inclined at an angle of less than 25° to the longitudinal axis of the body; segment 12 is about three-quarters the length of segment 11; segment 13 is a narrow, transverse strip not one-third the length of 12; segment 14 is a trapezoidal piece, narrowest at extremity, about as long as segment 12, the extremity faintly convexly curved, the lateral corners rounded with the lateral sides slightly constricted about the middle of segment, the basal half with the dorsal surface even and slightly tumid, the posterior half dented widely and the extreme margin somewhat linearly thickened; the fattest part of the body is the middle whence it thins to both ends. The *head* is perhaps best described as a short semi-ellipse, the straight base being a line across the mouth-opening under or through the labrum, the apex, widely and deeply emarginate in an evenly curved sinus, leaving each lobe with a prominent, bluntly rounded, gradually-formed, conical point; the surface is shining, covered with a network of thin, raised, somewhat irregular reticulations; no hairs; the true clypeus is triangular, the apex acute, higher than broad somewhat, rather less than half the height of face; the false clypeus reaches nearly two-thirds the height of face, has the apex acute also and is as broad as one-fifth the length of base of true clypeus, becoming, however, rapidly narrower at base; the labrum is a quarter the length of true clypeus and transverse, whitish; the ligula kidney-shaped, as long as labrum, whitish, the sinus shallowly, widely triangular; antennal, basal joints glassy-whitish, others dark; mandibles strong, their cutting edges shortly, coarsely toothed: colour dark; eyes arranged 1, 2, 3, 4 in a slight curve, equal-spaced, 6 in a straight line with 3, 4, three times as far from 4 as 4 from 3: number 5 behind, not as far from 6 as 4 from 6 and somewhat less again from 4, all black in colour; the colour of the whole dark reddish-black. *Surface* of the body is dull, smooth, the segment-margins distinct but thin; segment 2 shining and watery-white with a roseate tinge; the whole body covered with extremely short, moderately sparse, erect, light hairs, only visible under a strong lens; the prolegs are short, the bases thick, the feet circular; the true legs quite well developed. *Spiracles* small, light orange in colour, flush, roundly oval; that of segment 2 more than twice the size of the others; that of segment 12 like the rest but rounder. *Colour* is a light, neutral, greenish olive with a rosey tinge, especially in the contracted parts—when at rest in the front segments; the whole body dotted with white except on immediate dorsum on both sides of a dark, pulsating line; laterally, towards the front margin of segment 10 is a small, short, diagonally-placed orange mark (male organs ?) which are visible under the skin; the true legs are yellowish; the pseudo legs are the same colour as the rest of the body. L: 35 mm; B: 5 mm; but the length is somewhat more when really stretched.

Pupa.—Is similar in *shape* to that of *T. litigiosa*: fairly stout, circular in transverse section from shoulders to segment 12, about the same width from shoulders to segment 8 whence it thins to segment 13 which is a short, transverse, well-distinguished piece about half the length of 12 and three-quarters the breadth; the cremaster is Y-shaped, the stem broad, the arms triangular, with the space between them rather shallow: the whole piece easily twice the length of 13, the extremity slightly emarginate, bearing the bunched, suspensory hooklets or short hairs: the segment strongly down-curved; the front of pupa high and square, the vertex and frons in a plane perpendicular to the longitudinal axis of the pupa, the frons of head produced into a prominent, somewhat robust, short, round-topped, cylindrical process or snout which is as long as the distance between its base and the outer margin of the eye; segment 2 is transverse, inclined to the longitudinal axis at a considerable angle, about one-third the length of thorax, the margins slightly waved; the thorax is slightly humped, evenly rounded, the dorsal line nearly parallel to longitudinal axis at hinder margin, this margin shortly and broadly triangularly produced backwards in the dorsal line, meeting the wings in a broadly rounded, moderately deep angle of somewhat less than 90°; segment 4 about the same length as segment 5; segment 5 rather more than half the length of 6=7 = 8; the highest point of pupa is at the apex of thorax; the shoulders are not prominent. *Surface* dull, covered all over with very distinct, small, shallowly concave, shining, light orange pits in each of which is placed a short, recumbent, light, thin hair; the proboscis is shortly produced over the hinder margin of segment 8. *Spiracles* of segment 2 are large, circular, raised, convex, twice as long as the rest, spongy looking, light orange-grey in certain lights (these are the spiracular expansions)—and facing slightly forwards ; the rest are oval, flush, yellow, not small. *Colour* is greyish with a brown and pinkish tinge, the pits light orange, a black, subdorsal. central spot on thorax and a lateral one in front of it ; a black dot above each spiracle on abdomen and some more round the spiracles of segments 8-10 ; some brown lines along the dorsal wing-margins and similar lines on the wings themselves ; there is, sometimes, a cerous powdering. L : 20 mm ; B : 6 mm.

Habits.—The habits are very similar to those of *Tagiades litigiosa.* The young egg-larva makes a similar nest of a turned-over piece of leaf and the full-grown larva the same ; it always rests with the head turned round on the side and is very sluggish. The pupa is formed between two leaves or sometimes under the prepared cover, the leaves being held in place by a thread or two of silk like the cover. The stages take the normal time and, as a general rule, so does the pupal state though the larva sometimes lies over for an indeterminate time.

The egg is laid on the upperside of a youngish leaf, though never on a tender one ; each one (they are always laid singly) being covered over more or less with a light covering of fine, curley, soft, grey hairs from the extremity of the abdomen of the female. The little larva eats its way out of the side of the egg and makes its first cell by turning over a small, oblong piece from the edge on to the top of the leaf, forming a short tube by joining the edges and closing up one end. It lies on the underside of the roof with its back towards the surface of the leaf or bottom of tube. It is red in colour at both ends, a kind of neutral tint in the middle and the head is black. It is impatient of light and shakes its head violently, wriggling its body when exposed to it. In the later stages the larva behaves as does that of *Tagiades litigiosa* and makes its cell in a similar way. These larvæ are always found in shady places in the jungles of the Western Ghats in the Kanara District where the rainfall is anything from 100″ to 300″ and prefers the more or less evergreen stretches. The foodplant is *Dioscorea oppositifolia,* Linn, growing commonly in the underwood in the rains, thence climbing up shrubs and even trees. The eggs are nearly always laid close to the ground or on plants that grow up the faces of rocks. They are also found on *Dioscorea pentaphylla,* Linn., growing in similar places. Both these plants belong to the Yam family and some of the species are cultivated for their tubers which are eaten. The butterflies rest on the undersides of leaves with wings outspread horizontally, the fore wings not covering the hind ones. They fly rapidly and jerkily, erratically backwards and forwards in the underwood, often returning to the same leaf and are very difficult to see. They go somewhat sparingly to flowers but also occasionally to bird-droppings on leaves. The best way to catch them is when settled, but they have to be watched to their sitting places. A short *prr* from the wings as one flies past the ear is sometimes the first indication of an insect's presence in the jungle, the grey on the hind wings does not show up at all as it does in *T. litigiosa* and a sharp eye is necessary. The butterfly emerges from the chrysalis in the early morning.

Distribution.—" Southern India, Malay Archipelago, Java. The type was Javan, it is supposed to be in the collection de Perreux, Paris; the figure of *Tagiades athos,* Plötz, is said to be indentical with it and Plötz's species cannot be separated from our South Indian examples ; we have it from Kolar, Coorg, Karwar and Travancore ; Evans records it also from the Palni Hills, Watson from the Chin Hills and Wood-Mason and de Nicéville from Cachar ; our description and figures are from Travancore examples." (Colonel Swinhoe's *Lepidoptera indica,* vol. x, p. 44.)

The butterfly is quite frequently met with in the Kanara District practically from sea-level upwards but is more plentiful in the hills at about 1,500 and higher in the monsoon months. There are two if not three broods then and the only reason why it is not just as common at other times is that the foodplants lose their leaves in the cold weather and do not shoot again until the first rains fall.

(*To be continued.*)

NOTES ON A VISIT TO CERTAIN MUSEUMS IN GREAT BRITAIN.

WITH SPECIAL RELATION TO THE PRINCE OF WALES' MUSEUM, BOMBAY.

BY

S. H. PRATER, C.M.Z.S.

(*Read before The Bombay Natural History Society on the 26th April* 1923.)

(*With a plate.*)

During my stay in England I had the opportunity of visiting some of the principal Natural History Museums in the country, my object being to study their internal arrangements and organisation. The chief Institutions visited by me were the Natural History Museum at South Kensington, the Royal Scottish Museum at Edinburgh, the University Museum, Manchester, and the Museums at Birmingham, Leicester and Norwich.

Commencing with the Natural History Museum at South Kensington the visitor to this Institution is at once impressed by its size and the elaborateness of its arrangements, as befits an Institution imperial in its character and world wide in its scope. The collections are arranged in accordance with the modern view in two primary divisions.

(1) The study or reference collections reserved for advanced students.

(2) The general collections open to the general body of visitors.

The value of the arrangement will be apparent when we remember that the two main purposes of any museum are firstly research and secondly instruction. The whole treatment of its collections are therefore subjective to the furtherance of these two ideals. The two ideals are distinct, one implies the advancement of knowledge, the other the diffusion or spreading of knowledge and any combination of the two would lead to the accomplishment of neither.

For efficiently carrying out its first motive a museum should therefore have a comprehensive research collection ; this material is to be treated much as books are treated in a library, kept apart for people who are able to appreciate their contents. This collection is therefore set aside for those people who by the knowledge they have previously gained on the subject are able to examine its material and by their studies and observations are able to carry the subject further than the point at which they took it up.

The second motive of the Museum, its instructional motive, implies a totally different treatment of the collections devoted for this purpose. The instruction, in order to be effective, must be conveyed to as wide a circle as possible. The collection must therefore be arranged so as to be readily and equally accessible to as large a number of people as possible at any given time. The exhibits should be so arranged as to be useful not only to the student commencing his studies but also to the much wider class of people who have not the time, nor the opportunity, nor the abilities for studying any branch of science or art but who are still sufficiently interested in it to desire to possess some knowledge of the world around them.

The reference collections at South Kensington are arranged in rooms adjoining as far as possible the departments to which they relate. Here the vast material necessary for research work is stored. The work that is being conducted behind these closed doors forms the most important part in the life of the museum. The chief features aimed at in arranging the collection are firstly the storage of the materials where it will be protected from the ravages of damp and excessive light, secondly its ready accessibility, thirdly the provision of the necessary facilities for the work in the shape of a suitable reference library, which is absolutely essential to the efficient carrying out of any research.

The Museum comprises the five natural history departments of Zoology, Entomology, Geology, Mineralogy and Botany.

On passing through the main entrance the visitor enters the Central Hall. The specimens exhibited here are of a general nature illustrative of the important principles and matters of economic interest. Particularly interesting are the cases illustrative of insects in relation to disease. The various stages in the life history of the Anopheles and Culex Mosquitoes, the Plague Flea, House Fly, Bed Bug, etc., are illustrated by means of carefully prepared enlarged models showing the various stages in the development and growth of these insects and the important part they play in the spread of disease.

The educational value of such an exhibit can best be appreciated by dwellers in the tropics where diseases spread by the agency of these insects are so prevalent. My first idea on seeing these cases was a desire to have a similar series of cases in Bombay but the great obstacle in the way is the question of expense. Yet surely in this great City some public spirited citizen can be found who would be willing to defray the cost of preparing such an exhibit. Wax models would perhaps be unsuitable for this climate unless the models were made with high melting point wax. Papier-mache might however be found an efficient substitute.

The Central Hall also contains the Index Museum, designed chiefly for the use of students commencing their studies. The collection, because of its technical treatment, does not perhaps appeal to the general visitor but its value to the student cannot be underestimated. It forms an illustrated guide to his studies, a medium of ready reference in the many problems before him. The treatment of this collection at South Kensington is extremely detailed and elaborate and one could not but be struck with the great care and judgment with which the whole exhibit had been prepared, nor fail to be impressed with the time and labour the work must have entailed.

In Bombay, in order that there may be no over-lapping, I think the best venue for such a collection would be the Royal College of Science where students, for whose especial advantage such a collection is prepared, would have the advantage of its aid in their studies. For our Museum I should have something much less elaborate and more readily intelligible to the ordinary visitor.

Passing from the Central Hall by the main stairway one enters the corridors leading to the Mammal gallery. These corridors at present contain over-flow cases from that gallery.

As a whole the treatment of the exhibits in the Mammal gallery is good, but even here one meets with relics of the old " bird-stuffer's " art. These badly mounted specimens are being gradually replaced by animals mounted according to modern methods, perfect in form, proportions, attitudes, and almost, if not quite, as valuable for conveying information on these points as the living creature. I was taken into a lumber room filled with the condemned specimens and offered a selection of them for our own Museum. The offer was gently but firmly declined. As we are starting a new Museum we may as well start with the best that we can afford, and decide not to place anything in our galleries but what the Museum may be proud of.

The Bird gallery is situated on the ground floor. The collection here arranged contains :—firstly a series representing the various families and genera of birds, and secondly a series of groups illustrating the nesting habits of British birds. In the treatment of the latter subject we find the highest example of the modern taxidermist's art :—Nature copied with a marvellous exactitude. The idea behind this exhibition was presumably to have cases illustrating all the British nesting birds. Much of the beauty of the cases is lost by their being overcrowded. If there had been greater space or fewer cases they could have been seen to better advantage and the merits of each particular group better appreciated at its proper worth.

The Reptile gallery is the middle one of the five side galleries opening out of the Bird gallery and, in addition to recent reptiles, it contains several large fossil reptiles for which accommodation could not be found in the Geological Section. On entering this gallery the visitor is confronted with a collosal dinossaur, 84′-9″ in length. The reptiles are shown principally by means of casts and mounted specimens arranged on sloping boards in cases running parallel with the walls of the gallery.

The Fish, Shell, and Insect galleries adjoin the Bird gallery. The most prominent specimen in the fish gallery is a huge basking shark, 28′ in length, caught on the coast of Norway. One read in a local paper recently of a huge fish 700 lbs. in weight caught by the steam trawler close to Bombay. What a great opportunity has been lost of securing this unique specimen for the Museum where it could have been mounted and seen by visitors for years to come, instead of which it has been lost. I take this opportunity of appealing to people who are in a position to obtain such material to remember how gratefully the Museum would accept any assistance in their part in obtaining matter for its collection. In the recorded instance, if the Society had been informed in time, steps could have been taken to save this giant fish for the Museum.

In the Insect gallery I was particularly struck with the type of cases used, designed particularly to protect the specimens from light. Light and damp are the two most harmful factors to be contended against in exhibiting Zoological material. Specimens of butterflies, beetles, etc., exhibited in open glass cases are, in a comparatively short period, bleached almost white and, unless efficient steps are taken for their protection, they are rendered practically useless for the purpose intended. I had the opportunity of attending a very interesting and instructive lecture by Sir Sydney Harmer, the director of the B. M., at the Royal Society of Arts. The subject of this lecture was the protection of Museum specimens from light, and the results of a series of careful experiments protracted over a period of seven years were graphically illustrated. The outcome of these experiments has shown that science has not yet invented any methods effectively to counteract the deleterious effects of light, and the only possible recourse at present is to protect the exhibits from the action of light, direct or diffused, as far as possible by the use of screens, etc.

In most of the galleries at South Kensington one cannot but feel that the exhibits suffer from being rather overcrowded. The accommodation of such vast and constantly increasing material must remain a tremendous problem even when the much needed extension to the present building, now under course of construction, is finished and in use. In the words of Sir Wm. Flower—" A Museum cannot remain stationary. It must grow and expand and in the planning and design of Museum buildings unless allowance is made for such future extension the galleries become congested and the exhibits in the cases overcrowded. It has been written that the work of a Museum is never finished and that when collections cease to grow they begin to decay. A finished Museum is a dead Museum and a dead Museum is a useless Museum."

The next institution that I will refer to is the Royal Scottish Museum at Edinburgh, one of the best conducted and most attractive Museums in the British Isles. The whole arrangement of the collection evidences the care and pains that have been taken by the staff to attract and interest the ordinary visitor. One cannot help being struck with the general air of cleanliness and neatness and above all that complete absence of fustiness and decay, at times so prevalent in Institutions of this character. The Natural History Section of the Museum is represented by three main divisions : (1) the General Museum, (2) a gallery designed specially for the use of students and (3) a collection representative of the Fauna of the British Isles. The "student" section is very largely patronised by students of the local colleges. It is designed to form a conspectus of the animal kingdom from Protozoa to Primates and " to illustrate the bearing of comparative anatomy and development on classification, also to explain by actual specimens the technical terms used in Zoological descriptions." The display of a series of anatomical preparations, bones, etc., has been rendered attractive by the careful manner in which the material has been treated. The specimens are carefully mounted on specially selected back grounds and are seen to the best advantage.

The exhibits in the Mammal and Bird galleries have been rendered very attractive by the excellent standard maintained in the mounting and arranging of the various animals and birds. One cannot speak too highly of the work of the late Mr. Chas. Kirk, the taxidermist who was responsible for many of the cases. I should like specially to mention the case showing the nesting habits of a pair of golden eagles. The site of the nest was photographed from various angles as a guide to the taxidermist in his work. The rocks, grass, and herbage surrounding the nest have been accurately reproduced and the whole group makes a most attractive and pleasing exhibit true to nature in every detail. A feature of the Museum is the hall devoted entirely to the fauna of the British Isles. The material for this collection has been solely collected in the British area, both land and sea. The value of bringing and keeping together such a collection will be obvious when we consider that the young zoologist naturally begins by the study of the local fauna, and that naturally the pursuit of local zoology, in which so many older people are interested, must be forwarded by the same means.

With regard to the remaining Museums visited by me I might say that each of them provided new ideas of arrangement or new methods of treatment of the various classes of exhibits. The Beale Memorial Collection of nesting groups of British Birds at Birmingham provided a new idea in the utilization of the actual foliage of trees and similar vegetation used in making up the nesting sites of the various birds. At South Kensington these were represented almost exclusively by wax models, but in the present instance the actual leaves, etc., have been preserved and dried by a special method and subsequently coloured to represent them in their living condition. The first method, particularly with flowering plants yields the most beautiful results, but the method adopted at Birmingham is certainly more economical and perhaps better adapted to Indian conditions. At Leicester one of the most popular features is the Vivarium attached to the Museum, where live examples of fresh water fish are kept in concrete glass fronted tanks. The Vivarium also included living snakes, lizards, etc. Living flowering plants of the season, both wild and cultivated with names and other particulars, were shown on tables in this room which also included photographs of local trees in summer and winter condition with details of leaves, flowers and fruit. All these were of great interest to the visitors and this section of the Museum was always filled with interested spectators. The labelling of the various exhibits in the Museum was particularly good, both as regards the quality and colour of the paper used and the style of type adopted for the printed and hand written labels.

OUR POLICY FOR BOMBAY.

The Natural History Section of the Prince of Wales' Museum is now under process of construction, we have before us a clean slate to work upon. It is essential therefore that we keep before us a certain policy or a foundation upon which we should build up this Section. As I said before the main purposes of a Museum are, primarily the advancement of knowledge and secondarily the diffusion of knowledge. For the furtherance of the first motive we must have the necessary materials in order that effective research work may be conducted in this city. One of the prime necessities is an efficient library. How greatly we are lacking in this respect can only be realised by those who have attempted to undertake work of this description. We have before us in Bombay a virgin field for research particularly as regards Vertebrate Zoology, especially in the department of Marine Biology. Further our Society possesses a large collection of birds, a comprehensive collection of mammals containing co-types of nearly all the recently described Indian forms, and a not unimportant collection of reptiles. In our City the advanced student has therefore excellent material for his work but remains handicapped for want of the accompanying literature, which is a *sine qua non* to the successful carrying out of a work of this nature. As regards the second motive of the Museum, *i.e.*, its Instructional side, the furtherance of this motive will depend entirely on the arrangement of the exhibits in our public galleries and whether we render them attractive and intelligible to the average visitor, so that the man who decides to spend an idle hour in the Museum Building is not only pleased and attracted by what he sees but also derives a certain amount of instruction and benefit from his visit. To carry out this purpose the material to be shown must be carefully selected. It must be restricted and limited in accordance with the nature of the subject and the space available. Specimens must be placed in a position where they are easily seen, not too high nor too low, and above all there must be no overcrowding. Every specimen should have a definite purpose, and duplication should not be permitted. Above all the purpose for which a specimen is exhibited and the lesson it is intended to convey must be plainly indicated by the label. A well arranged educational Museum has been defined as a collection of labels illustrated by well selected specimens. Lastly, besides having a definite purpose to fulfil, it is most important that a Museum should have the necessary means to maintain it in a suitable manner if it is at all to justify its existence. This, in short, spells funds. Without money nothing can be done. It is not sufficient to provide a building if the people who are responsible for applying that building for the purpose to which it is intended are continually harassed by lack of means and have continuously to resort to temporary make-shifts because of the paucity of funds at their disposal. Repeatedly in the course of our work our ideas have had to be remodelled because it was necessary to have something cheaper. The best can only be got by paying for it and we appeal to those who are in a position to help us, to grant us that necessary measure of financial support and assistance that will enable us to carry out the work that we have set our hands to.

PRINCE OF WALES' MUSEUM.*

ARTIFICIAL LIGHTING.

The system of inverted lighting as adopted by the majority of Museums is considered the best provided the volume of illumination is sufficient. The system has the advantage of spreading the light more evenly and reducing shadows. The character of the ceiling from which the light is reflected and diffused is an important consideration. A dead white low ceiling would give the best results. The galleries in the upper floors of the Museum could be illuminated in this manner with good effect. 200 candle power gas-filled bulbs will be found the most suitable.

PROTECTION OF SPECIMENS FROM LIGHT.

The two influences most destructive to Zoological material are bright light and high temperature, and it is of the utmost importance that adequate provision be made for protecting the exhibits in the galleries. Experiments have shown that the glazing of the windows by specially prepared tinted glass to cut off ultra-violet rays, while delaying the bleaching processes, will not in the long run produce the desired effect. If the galleries could be lit entirely by artificial light (which being deficient in actinic rays is not in any way as harmful as sunlight) a measure of success might be achieved but this would be impracticable and our only recourse is to endeavour, as far as possible, to shield

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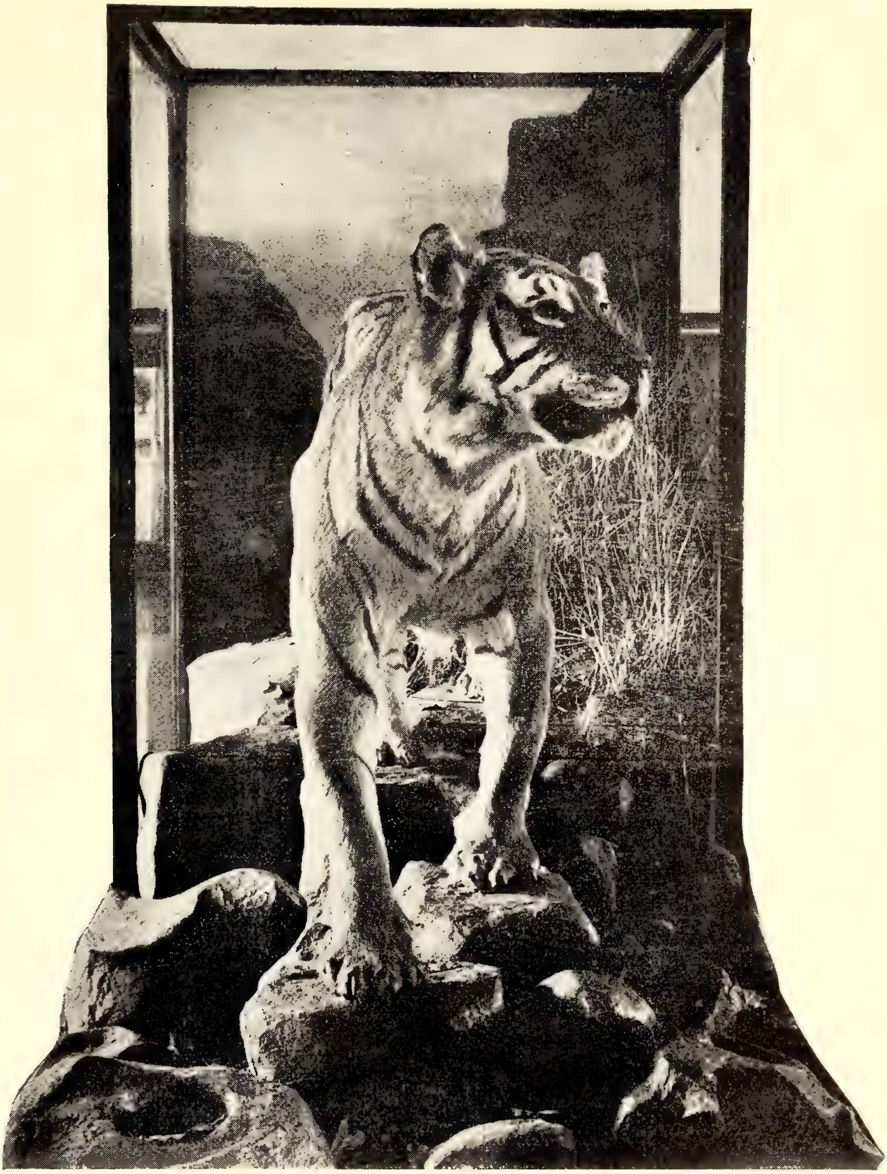
* Report to the Chairman, Committee of Trustees in charge of the Natural History Section, published for information of Members.—EDS.



TIGER SHOT AND PRESENTED BY A. A. DUNBAR BRANDER, ESQ., I.F.S.

Photograph of a case standing at the head of the Mammal Gallery, Prince of Wales' Museum. Designed by Mr. S. H. Prater and mounted by Mr. L. C. Harwood, Hammersmith, London.

the cases from the harmful effects of sunlight direct or diffused. The exhibits in the Mammal gallery are particularly exposed. The galleries in the Science Museum in London are constructed much on the same principle, and the difficulty is here obviated by placing removable canvas screens over the lower half of the windows to shield the cases from direct light. These frames have the further advantage of offering additional wall space for hanging photos and diagrams, and I would recommend their introduction in the Mammal gallery ; the upper half of the windows may be protected by roller blinds.

GENERAL DIVISIONS OF THE MUSEUM.

The ideal arrangement would be three general divisions :—(1) A student's gallery to consist of a Zoological type collection brought together specially to meet the wants of students whether engaged in private study or attending lectures. Its aim would be :—

1. To afford a general view and conspectus of the animal kingdom and to illustrate the bearing of comparative anatomy and development on classification.
2. To explain by actual specimens the technical terms used in Zoological description.

Before we can adopt any of the above methods and apply them to our own conditions there are several points to be decided.

At the Edinburgh Museum there is a gallery particularly intended for the use of students in which the exhibits are arranged to form a conspectus of the animal kingdom from Protozoa to Primates viewed particularly from the standpoint of structure, anatomy, classification, including illustration of scientific terminology, etc.

The whole arrangement is intended for the use of the University student in particular and as such is planned on a most elaborate basis. I have taken very careful and detailed notes of the arrangements in this gallery in case this type of exhibition would be required, but in my opinion an elaborate arrangement of this nature comes exactly within the scope of the Royal College of Science who ought to provide for the University student.

If it is intended to provide for the ordinary visitor, the exhibits would have to be of a more elementary nature so as to be more readily understandable.

The alcoves, modelled on the lines of the Index Museum at South Kensington, proposed in the original Museum scheme out of the question. We must confine ourselves to a more elementary arrangement taking for our model the "Introduction to Vertebrate Zoology" Case in the central hall at South Kensington. I have taken notes as regards the details of the cases and propose taking the matter in hand immediately.

(2) The second division of the Museum would consist of the general galleries devoted to the particular orders of the animal kingdom, *i.e.*, mammals, birds, reptiles, etc.

Applied to our own Museum these galleries could be arranged as follows :—

Mammal and Bird Gallery—Ground Floor.
Reptile, Fish and Invertebrate galleries—Mezanine floor.

At present we have only one gallery in the mezanine floor but it is possible that the gallery now occupied by the Forest section will eventually become available.*

(3) The third section of the Museum should contain a single gallery devoted entirely to the Fauna of the Islands of Bombay and Salsette. The value of bringing together such a collection will be obvious when we consider that the young Zoologist naturally begins by collecting and examining the fauna of his own locality. This section should contain specimens of everything vertebrate and invertebrate that it is possible to obtain locally and would be limited to

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* Since this was written the gallery has become available.—S. H. P.

specimens actually obtained in this area. I would limit this area to the Islands of Bombay and Salsette.

I have put forward this idea as one of the aims of the Museum. For the present we must limit ourselves to collecting the material which would eventually be available for such a section.

So much for the general divisions.

Now as to actual work :—it was originally proposed that work should be concentrated on one gallery at a time but it would be a great mistake to concentrate on one department. The position must be attacked from all sides. We should be able to show in the first place a brief outline of the animal kingdom which can be gradually enlarged and elaborated. Our main difficulty is the provision of show cases. This is purely a question of funds but the work of preparing the material for the cases should be proceeded with. A Natural History Museum cannot be evolved in a day. Zoological exhibits require time for assembly and preparation. Notwithstanding the above difficulties our policy would be to make use of the material we have and use such cases as are at present at our disposal. In our Mammal gallery for instance I propose showing a certain number of birds as we have no cases for this gallery at present.

Until the cases are built and the specimens prepared we must be content with temporary measures.

INTRODUCTORY CASES TO VERTEBRATE AND INVERTEBRATE ZOOLOGY.

These cases will be temporarily accommodated in the Mammal gallery. The material for these cases is now being assembled. The use of certain diagrams are necessary in connection with these cases. Diagrams will also be required for illustrating some of the lower orders of the Invertebrates as we cannot for the present contemplate the purchase of models ordinarily used for this purpose. It is therefore recommended that the Principal of the School of Art be communicated with to assist in engaging the services of a student to carry out this work. It is proposed to prepare for each section (mammals, birds, etc.) an introductory student's case. Thus for the Mammal gallery it would be necessary to arrange a case which would form an introduction to the study of mammals. The material for this case is now being assembled.

MOUNTED SPECIMENS.

A certain number of mammals have been mounted in England. These are now on their way out and others are being prepared. The specimens so far completed will in no way fill the cases and it will be sometime before we can have a fairly representative collection of mounted exhibits. It will therefore be necessary to complete the exhibit by the use of flat skins which can gradually be withdrawn as the mounted specimens are ready. The skins should be shown on sloping screens where they will be more readily visible. Certain of the centre cases should be fitted with plate glass shelves on moveable brackets. A design for the moveable bracket has been prepared and an estimate for their supply has been called for from Messrs. Choong Sang. The wall cases should similarly be fitted with shelves or with sloping frames. The smaller mounted mammals and birds can be easily attached to these frames where they may be seen to advantage. The system also affords facilities for labelling and the separation of the various families and genera. The interior of these cases should be painted a pale buff as the varnished teak is not the most suitable background for displaying the exhibits to the fullest advantage. The tops of the cases are at present covered with sheet glass. This should later be substituted with frosted glass which does not show dust and allows a sufficiency of light.

MOUNTING.

Work has already commenced in connection with the mounting of specimens. It was considered advisable not to wait for the arrival of the necessary tools and accessories from England but to proceed with the work at once using the material we have in hand. The policy will be to select types for each case, not concentrating on one case but gradually building up a skeleton outline which can be gradually amplified. Work for the present will chiefly be carried out with smaller mammals and birds. As the men become more competent, larger specimens may be attempted. Wherever possible natural mounts for the animals should be used instead of polished wood. The stand or pedestal should as far as possible indicate the habits of the animal, *i.e.*, arboreal animals should be mounted on branches, etc. The inclusion of grass or foliage among mounted specimens on shelves should be avoided. This should be reserved for habitat groups.

Skeletons should not be included with mounted exhibits as they detract from the æsthetic appearance of the cases. They should be shown together in a separate case or cases, which method offers the additional advantage of affording facility for purposes of comparison. This system has been adopted in the Bird gallery at the Edinburgh Museum with the best results.

Bird Gallery.

No cases have been built for this gallery at present and it is proposed for the time being to show a series of flat skins in the Mammal gallery cases. Meanwhile the work of preparing the mounted specimens should be proceeded with. A certain number of birds have already been set up in England and will shortly be available. The difficulty of preparing birds is that the best results in bird work are obtained with fresh killed specimens. When these are not available old skins have to be relaxed and set up and these do not always yield the best results. It is proposed to collect material locally in order that work may first be done with fresh skins. With the acquirement of greater skill in manipulation it will be possible to work with dried skins with a greater chance of success. There is no royal road to success in this or any other art. It is a question of practice and perseverance. As regards arrangement of cases the space at our disposal is very constricted but a study of similar galleries in some of the Provincial Museums has shown that it is a difficulty which can be overcome. At Edinburgh the width of the Bird gallery is only 10′-2″ and the length 80 feet but by using a particular type of case they have managed to build up a very pleasing and attractive exhibit. The gallery is composed of a series of wall and box cases. 24 "box" cases contain the passerine birds, the wall cases the larger species. I have made a plan of this gallery and have measurements of the cases and would propose adopting the same for ourselves. The birds are all mounted on twigs and branches fixed to wooden bases. The bases are either of uneven shape made up of composition covered over with moss and short grass, or are square wooden pedestals with the upper surface sprinkled with earth. The labels are attached in each instance to the pedestals either pasted or attached with a label holder. For the case illustrating an introduction to the study of birds I would use as my model the cases at the Norwich Museum. The material is arranged in a desk case mounted on grey card and illustrates structure, anatomy, the various systems, etc., in birds.

Nesting Groups.

This should not be attempted for the present until the general exhibit is arranged. Then perhaps we might have a few nesting groups but these should be very good. In this matter it is possible to have an embarrassment of riches. Wax modelled leaves would be too expensive and these would in any case have to be prepared with high melting point wax. In the Beale Memorial Collection at Birmingham natural leaves have been used which have been treated by a special process, and which has very kindly been explained to me by the Curator.

The leaves are dried in sand, the process of drying being retarded as much as possible. With this treatment the leaves retain their original shape. They are afterwards carefully coloured with the best oil paints. The effect is extremely realistic, not perhaps so beautiful as wax but, considering the expense of the former method and the risk attached to its introduction in our climate, the second process would be the most suitable and would be worth trying. But, as I said before, nesting groups must be left to the end. We must learn to walk before we can fly. We can for the present, where possible, introduce nests in the general cases as is now being done in South Kensington.

The colour and quality of paper for labelling is an important consideration. In Bombay labels suffer terribly during the monsoon and have a tendency to become mottled. The type of label used in the Leicester Museum would perhaps be the most suitable for our purpose. The labels are printed on a thick buff coloured " linen paper. " I have brought some samples with me.

REPTILES, AMPHIBIANS AND FISH.

These are at present included with the invertebrates in the single gallery on the mezanine floor. The extremely restricted space at our disposal in this gallery forms a great hindrance to the proper display of the exhibits. Should the gallery at present occupied by the Forest Section be handed over to us matters would be very considerably improved. I would then reserve this gallery for reptiles, amphibians and fish and transfer the invertebrates to the new gallery. The newly acquired space would fill our requirements for a very considerable time.

As regards the treatment of exhibits these would mainly take the shape of casts, mounted specimens and spirit specimens. I have designs as regards the type of cases that would be required. As in the other galleries we should prepare introduction cases to each of the section.

As regards the actual work of preparing specimens, I should advise taking this up in the monsoon as this would be the most suitable time for it. Between June and October it will not be possible to mount many animals and birds chiefly because of the difficulty of drying the material properly, but the preparation of casts, etc., need not be inconvenienced on this account. Very beautiful casts of the smaller reptiles and amphibians are made with gelatine in England. This medium would, I am afraid, be unsuitable for this climate but I am of opinion that a suitable substitute could be found that which would yield equally good results : I mean printer's roller composition which is largely used in India. The material is readily soluble and has the necessary elasticity after setting. The experiment would be worth trying.

INVERTEBRATES.

Except as regards insects our collection is notoriously weak in invertebrates. Matters might possibly be remedied by appealing for assistance to the Indian Museum at Calcutta and availing ourselves of the assistance offered by the Zoological supply section of the Madras Fisheries Department. I have communicated with Mr. Hornell on the subject.

As regards the lower invertebrates, for the present we must rely more or less on diagrams. Later we may be in a position to purchase certain models for the better illustration of this section. It would be cheapest to obtain these from Germany. I have catalogues of certain German firms who make a speciality of this work and it may be possible at present to obtain a certain amount of the material required at a comparatively low cost. Meanwhile it is recommended that a suitable artist be engaged for the work of preparing the necessary diagrams for this section. We have commenced work with the insects and it is proposed in the first place to show an outline of the various orders of insects and illustrated by a few examples of the various families. It is a wrong policy to have a fairly complete exhibit of butterflies and practically nothing on view illustrating the other orders. Cases are also being prepared illustrating the classification and structure of insects which it is hoped will be a help to students of the subject. Our treatment of the Mollusca will be conducted on the same lines. We will show a general outline of the Phylum which will be proceeded by an introductory study case. Conditions of space prevent a more elaborate treatment of the subject.

So far as regards the main galleries. In addition to the above it is recommended that we should undertake the preparation of certain exhibits illustrative of the subject of insects in relation to disease in India. The subject is very elaborately treated in the Central Hall at South Kensington. The methods employed there are perhaps beyond our means but I believe it is possible to illustrate the subject in a simple way by the use of diagrams and photos. The expensive wax models of the house fly, anopheles and culex mosquito would in the first place be unsuitable for this climate but I am of opinion that it is possible to obtain cheaper models in papier mache. Enquiries must be made in this direction. The utility of such an exhibit in Bombay need hardly be commented on and I should strongly recommend the matter being taken up.

Before closing the summary I would like once more to lay stress on the absolute necessity of a very determined effort being made towards obtaining the necessary funds for the carrying out of the work that we have set our hands to. The paucity of our resources remains at present the chief bar to the successful carrying out of the project.

In drawing up this report I have endeavoured to show that the main object we have before us is to make some show with the material at our disposal; a proper supervision and steady application to work in all the department cannot but yield results. If when appealing for financial assistance we could show what has been done in spite of difficulties we could look with greater confidence to a readier response to that appeal.

In conclusion I take the opportunity of tendering my thanks to the Committee for the opportunity afforded me of studying at first hand the arrangement and organisation of the Museums in England and on the Continent. It is my hope that this far seeing policy will not be long in yielding its desired results.

NOTES ON A COLLECTION OF SNAKES FROM SINLUM KABA.

By

F. Wall, C.M.G., Colonel, I.M.S.

Our Society is much indebted to Mr. P. M. R. Leonard for a collection of snakes from Sinlum Kaba, Upper Burma Hills, circ. 6,000 feet (Lat. 25°, Long. 97°) which includes many rarities, and one species hitherto undescribed.

Family Colubridæ.

Rhabdophis subminiatus (Schlegel).

A single adult.

Natrix leonardi spec. nov.

A single specimen, apparently adult.

Lepidosis.—Rostral. In contact with six shields, the rostro-internasals, and rostro-nasals subequal, and rather longer than the rostro-labials. *Internasals.* Two; truncate anteriorly, the suture between the fellows subequal to that between the praefrontal fellows, rather less than the internaso-praefrontals. *Praefrontals.* Two; the suture between the fellows subequal to the praefronto-frontals. *Supraocular.* Longer than the praefrontal and internasal taken together, rather shorter than the frontal, two-thirds the parietal, subequal to the anterior temporal. *Frontal.* Longer than the snout, four-fifths the parietals. *Nasals.* Two; the nostril in the anterior shield, and about the upper three-fifths of the suture. *Loreal.* One, as long as deep. *Praeocular.* One. *Postoculars.* Three (Two on the left side owing to a confluence of the two lowest.) *Temporals.* 1 + 1. *Supralabials.* 7. (The 5th and 6th are confluent making them appear 6). The 1st and 2nd touch the nasals, the 3rd and 4th the eye, 4th and 5th the temporal. *Infralabials.* 6; the 6th touches three scales behind; its length is three-fifths, and breadth twice that of the posterior sublinguals. *Sublinguals.* Two pairs; the posterior longer than the anterior, separated by 1 + 2 scales. *Costals.* Two headslengths from head 17, midbody 17, two headslengths before vent 15; keeled except in two or three last rows; emarginate. *Ventrals.* 152. *Anal.* Divided. *Subcaudals.* 46, divided. *Dentition.—Maxillary* (left) 18 teeth; the last three progressively enlarging, the last not twice those in the middle of the series, syncranterian, anododont.

Colour.—Uniform olivaceous-brown dorsally, the overlapped edges of some scales, especially in the fore part of the body, whitish and blackish. A narrow rufous nuchal cross bar ending on the last row of scales. Ventrally dirty whitish, very finely peppered with grey, the peppering increasing in intensity posteriorly. A black ill-defined median stripe in the forebody becoming more intense and broader as it proceeds posteriorly. Beneath the tail ferruginous, finely peppered blackish, which is heaviest at the base of the tail where it forms a median stripe. Head olivaceous-brown, merging to dirty whitish at the edge of the lip. A narrow black subocular stripe on the posterior border of the fourth supralabial. Infralabial sutures unpigmented.

Pseudoxenodon angusticeps (Blyth).

One typical adult.

Trirhinopholis nuchalis Boulenger.

A single specimen. *Costals* 15 in the whole body. *Ventrals* 140. *Anal.* Entire. *Sub-caudals* 26, divided.

Plagiopholis blakewayi Boulenger.

Three examples, ♀ 308 mm. (12¼ inches), tail 35 mm. (1⅜ inches); ♀ 342 mm. (13½ inches), tail 46 mm. (1⅞ inches); ♀ 225 mm. (9 inches), tail 24 mm. (⅞ of an inch). Previous to these only one had been discovered since the description of the type in 1896. The second specimen was also from Sinlum Kaba, and is in our Society's collection.

Lepidosis.—Costals. In 15 rows in the whole body length. *Ventrals.* 128, 128, and 127. *Anal.* Entire. *Subcaudals.* 22, 21 and 20, divided throughout. *Loreal.* Absent in all. *Mental.* Unduly large, and in contact with the anterior sublinguals, as noted in the type.

Colouration.—The smallest is light brown dorsally, many scales being edged with black, and others with buff to form a fine variegation. A series of rather indistinct dorso-lateral black spots. A black chevron on the neck, its apex touching the interparietal suture, the arms reaching to the last costal row. Ventrally pale yellowish with small black spots, very sparsely and irregularly disposed. A black line anteriorly on the confines of the ventrals and last costal rows. Head brown above merging to white on the lips. A black spot in the suture between the praefrontal and internasals, a similar black spot in the suture between the parietals and frontal. A smaller black spot anterior to the middle of each parietal shield. Middle of rostral, and all the labial sutures black. Middle of mental, and all infralabial and other sutures black.

The largest specimen is a darker brown dorsally, otherwise like the last, except that the black spots on the head are wanting. Lips and chin as in the foregoing. The intermediate specimen is uniform slaty black, the dorso-lateral series of spots difficult to discern. No vestige of a chevron on the nape. No black spots on the head. Lips and chin as in the first specimen.

Coluber leonardi Wall.

A very fine specimen of this species—the third known, is apparently an adult. It is a ♂, measuring 685 mm. (2 feet 3 inches), tail 112 mm. (4½ inches).

Lepidosis.—Rostral. As in the type unusually broad; the rostro-internasal sutures are more than twice the length of the rostro-nasals. *Nasal.* Elongate and entire. *Loreal.* Wanting. In the figure accompanying the description (in the Bombay Nat. Hist. Journal, Vol. XXVIII, No. 1, page 43) this was faultily represented, calling for a correction slip which appeared later (Vol. XXVIII, No. 2). *Costals.* 19 two headslengths behind the head, 19 in midbody, and 17 two headlengths before the vent. *Ventrals.* 210. *Anal.* Divided. *Subcaudals.* 56, divided.

Oligodon herberti Boulenger.

One fine specimen. This is the second obtained by Mr. Leonard at Sinlum Kaba, and the third known. *Length.* 400 mm. (1 foot, 7¾ inches), tail 68 mm. (2¾ inches).

Lepidosis.—Internasals. Wanting, as in the type, so that the rostral touches the praefrontal shields. *Nasal.* Entire. *Loreal.* Wanting. *Postocular.* One. *Costals.* 13 in the whole body length. *Ventrals.* 192; (not angulate). *Anal.* Divided. *Subcaudals.* 39, divided.

Colouration.—There is no trace of the head marks which are so characteristic of most species of the genus, the crown being heavily suffused with blackish. The light dorsal stripe is not constricted any where and passes to the tip of the tail. The tail is unspotted beneath.

Liopeltis frenatus (Günther).

One juvenile ♂ ? example from an elevation of about 3,200 feet. This species was previously only known from the Khasi Hills, Assam.

Length.—323 mm. (12¾ inches), tail 93 mm. (3¾ inches).

Lepidosis.—*Supralabials.* 8, the 4th and 5th touching the eye. The 2nd on the right side is cuneate and fails to reach the edge of the lip. *Costals.* In 15 rows in the whole body length. *Ventrals.* 152, *Anal.* Divided. *Subcaudals.* 100, divided.

Psammodynastes pulverulentus (Boie).

A single half grown example.

Naia tripudians Merrem.

The head of one anocellate specimen.

Calliophis macclellandi (Reinhardt).

One specimen of variety *gorei*, Wall. This extends the previously known habitat. I have recorded it from Burma (Manipur), once before, but not from Hills so far East as Sinlum Kaba.

Colouration.—Brown dorsally with 32 vertebral black spots on the body, and 5 narrow black rings on the tail (The 24th, 25th and last six spots on the body are replaced by rings.)

PROTECTIVE COLOURATION IN WILD ANIMALS.

An application to animal life of camouflage principles taught during the war.

BY

Bruce P. Tailyour.

In considering the question of protective colouration in wild animals there are three points that seem to me to be too often missed.

Firstly, that in 90 per cent. of wild animals, birds, insects, &c., the protective qualities possessed by their body patterns are not due to "MIMICRY." Secondly, that there must be a further force besides that of body patterns representing an animal's background, in order to enable a solid animal to merge itself into its background and appear not to be there at all. Lastly, that this question must be viewed from the point of view of each animal's natural enemy—not from man's view point on encountering wild animals in the jungle—this is more necessary in the case of birds and insects.

Let us consider the first point enumerated above—that of mimicry. I have often heard the following kind of statement made during a discussion on shikar at the club bar or over the dinner table "Yes, you know, although "I was only 15 yards from the beast, staring straight at her, I could not make "her out. Suddenly she twitched an ear, and then her whole outline stood "out, and I saw her clearly. Extraordinary you know, I thought she was "an old tree stump before, exactly like one till she moved." Such a statement is generally made by speakers without any forethought on what they are saying. If such speakers would just think over such an incident carefully again, I am sure they will recognise the fact that they really did not take the beast for an old tree stump. That in fact as they stared to find her, there appeared to be no break in the background they looked on, no tree or stump that particularly caught their eye at the time, only a normal background containing ordinary jungle phenomenon. In fact they must have looked clean through the beast, so to speak. To the scientific mind, this question of mimicry fails in the case of the larger animals by the fact that such jungle objects as trees, stumps, rocks, &c., are each of one colour all over and therefore must possess highlights, and shadows in the daylight, and so must be recognisable for what they are—this point I will go into in more detail later on.

The second point mentioned by me as too often overlooked will be best shown as an important and essential fact to the subject under discussion by quoting a few simple experiments that anyone can carry out and prove for themselves. In the case of the wild animal we have a solid particoloured object dissolving itself into its background, and so being quite concealed from the observer. Now if we put a coloured screen, and fix a smaller and exactly similarly coloured screen some distance in front of, and parallel to the former, we will find when viewed from a short distance from in front that the small screen will not be visible, but will merge itself in and be lost in, the large screen behind it. If for the small screen we substitute a solid object similarly coloured as the screen behind—we will find that this solid object can always be seen, and recognised as a solid object, between the observer and the background (*i.e.*, large screen). In the first case concealment takes place, in the latter such is not the case. In the first case the thing concealed was a plane, in the second case when a solid was used no concealment takes place. But in the case of the solid animal in the jungle concealment against its background does take place under similar circumstances as described in the experiments above, and therefore another force besides that of the possession of a coat whose colours represent its owner's background (a coat possessed by the solid object of our experiment) must come into play in order to produce obliteration in the case of the animal, which is a solid body against its background, and in fact another force does come into play, which force I will touch on later in this paper.

The last point, as I have already stated, concerns the question of protective colouration in birds and insects more than in animals. Obviously if their body patterns are protective, they are designed against their owner's natural enemies, and such enemies of birds are chiefly the large birds themselves. Thus man walking on his flat feet seldom gets the same view of the birds that is vouched to their natural enemies, whose life is lived in the air above jungle tops. When I first started studying this question of protective colouration in practice in the jungles I very soon realised that whatever it was, it was not "MIMICRY" that gave the concealing properties to the coats of wild animals, as when I failed to spot an animal it was not that I mistook it for some other jungle object but that I never saw it at all, there seemed to be no break in the background. I was looking at—in fact I seemed to see through the animal that was there. I then tried experiments such as putting large boulders in front of a background of similar rock, branches of shrubs and trees in front of a background of similar shrubs and trees, &c., but in all cases, though sometimes not quite clear as to detail, I had no difficulty in spotting the solid object between myself and the background. I then tried a solid object against a vertical screen in my garden, both being coloured similarly, but with the same result. Curiously enough it never occurred to me to try a small screen in front of a large one as I did later. Had I done so I should probably have reached my final conclusions at a much earlier date.

It was as a matter of fact a chance remark that I heard one day in a train, combined with many idle hours in the class rooms at school, and experience and argument as a gunner in the war, on the uses of camouflage, that gave the clue that led me to the explanation that had puzzled me so long, as to why a solid animal could obliterate itself against its background, while the models, rocks, bits of branches, &c., that I had experimented with, although of the same materials as their backgrounds, never did disappear, in that way. Of course at this time I had accepted the fact that the majority of animals' coats must represent their typical backgrounds as otherwise no kind of obliteration would have been possible—hence my experiments with rocks, in front of rocks, etc. For seven years while at college I attended a two hours' drawing lesson weekly. In my first lesson I was given a square, modelled in wood, to draw; in my last and final lessons seven years later it was still the same old square I struggled with—in fact I could never draw a line. After two years I was left alone to occupy myself how I liked during the drawing lessons—being considered beyond hope as an artist. I used to occupy my time drawing fearsome cubes, so called pyramids, and weird solids of all kinds, of my own creation, and shading their various faces, angles, &c. After some years of this kind of thing I learnt one fact, which was amplified when I came to study camouflage during the war, and that was, that by means of shading, I could alter the apparent shape of an object, or obliterate a corner, or projection of an object, in the drawing. When not amusing myself with these wonderful efforts at drawing or using the time for preparation for the coming French or Math. lesson, I used to wander about among the other boys admiring their work and chatting, on the pretence of borrowing a knife or rubber. I love drawings and paintings although I cannot do a thing myself in those lines, and I used to spend a lot of time watching the knuts of the class at work. I was struck at once by the extraordinary contrast between the shadows and highlights depicted by these professors on their blocks–both seemed to be made to show up to an almost exaggerated degree of intensity (mostly drawings from wooden models). Again after some time of inspecting these drawings weekly it dawned on me that it was by means of highlights and shadows that we recognise "shape." When we look at a solid object our eyes automatically follow the lines of its highlights and shadows, and thereby realise its shape. Thus those idle hours at school taught me two things—the "shape-changing" power of counter-shading, and the essential presence of highlights and shadows to recognise shape.

The remark I heard one day was made by one of two men who were arguing heatedly on this subject of protective colouration possessed by wild animals. I was reading and at the same time half listening to this argument—a subject that interested me, and heard one of the gentlemen say, "Well you must admit that a fact, that is almost universal, must have some bearing on the case, and the fact, that animals are coloured dark on top of their backs shading down to white under the belly, is almost universal—I call it counter-shading." Directly I heard the words "I call it counter-shading" my brain seemed to flash back to those school-day drawing lessons, and the facts I had learnt there regarding shading, highlights and shadows; my experience in France with camouflage; and connecting up those items with my experiments in the jungle, drew its conclusion and worked out a theory, that takes 10 minutes to write, all in a flash—as one's brain does in its marvellous way—when a brain wave strikes one; and I found myself saying, "Why, of course, counter-shading, how simple, what a fool I have been not to have seen it before." If animals possess counter-shading, then, seen under proper circumstances, they would possess no highlights nor deep shadows, and so the eye could not follow their shape, hence they would be reduced to a blotch of colour with no solidity,—a plane in fact,—and, if its colour were similar to that of its background, it is feasible to think that it would be absorbed into, and not be visible before, its background. Whereas in the case of my models they could not conceal themselves against their similar backgrounds because, not being counter-shaded, they must comply with the ordinary laws of light, and possess highlights on their parts turned towards the daylight, and shadows on their parts turned away from it, and the eye, following their highlights and shadows, must be able to pick out their shape and solidity.

It was after that I took my model (a rough irregular lump of wood painted white with blotches of blue and black on it) and tried to give it counter shading—that is darkening it on the top parts where the daylight would naturally give highlights, and whitening it on its under parts where the light would give shadows, and viewed it in front of my screen (a white sheet with blue and black blotches over it). Being no artist my work was very kutcha, and my valuation of the depth of counter-shading not very good at the start, but even so I found my model much harder to see that before—finally I got a counter-shading of a fairly correct value and was satisfied with my results—almost complete concealment taking place—and concluded that, given counter-shading and similarity in colour as its background, a solid object can become invisible to an observer when placed near and in front of a similarly coloured background.

It then occurred to me that as by reason of its counter-shading an animal can loose its solidity and reduce itself to a coloured plane, and as that plane is invisible in front of the animal's background, it would be easy now to show that the colour of the animal's body must approximate to the colour scheme of its background or concealment could not take place. To satisfy myself on this point I cut a smaller screen out of my background screen, and interposed it vertically near and in front of the latter, and found that from a short distance the smaller screen was not visible—it merged itself into, and was lost in, the larger screen. I repeated the experiment with a screen of a different colour pattern to that of the background screen, and found that it was visible, and could be seen before the background screen. These experiments confirmed the fact that for a plane to be invisible before a larger plane placed behind it, both planes must be of the same colour pattern, *i.e.*, that where an animal in the jungle is invisible to an observer his body patterns must approximate to the patterns of his background, for by reason of his counter-shading he has lost solidity and become a plane.

Thus I concluded that all wild animals possessed protective colouration, and its power of protectiveness lay in its power of concealing its owners when seen against their common backgrounds, which power was due to (1) possession of counter-shading, (2) possession of body patterns that were pictures of the wearer's common background.

Early in this paper I ruled out "mimicry" as the guiding principle of an animal's coat patterns, and also the possibility of mistaking an animal for a tree trunk. The reason being that all jungle objects such as rocks, tree stumps, &c., have no counter-shading, and must therefore possess highlights and shadow in the daylight, and so always be recognisable as solid objects. But that there are cases of "mimicry" used as a means of protection among animals is undoubted, but such cases must be very few and chiefly confined to very small animals and insects. The only cases I personally have come across are those of the "stick puchee" who can resemble a dead twig to perfection; a long thin snake, emerald green, that climbs into low bushes and resembles the young green branches with excellent results; a species of butterfly that adopts a colouring and pattern approximating to that of one of its neighbours who is immune from attack on account of its unpleasant odour; and a butterfly commonly found under tea bushes among dead leaves that is itself a perfect replica of a dead leaf.

My bungalow is built on the top of the one of the highest points in the district. The top of the hill on which it is built is so small as to be only just large enough to take the bungalow site, hence I have a bird's-eye-view from my verandah on to the grass lands and jungle tops immediately below me. In the early morning the grass lands and jungle tops are alive with birds of many kinds engaged in feeding. The most numerous of these feeders is the hill parrot—a most gorgeous fellow dressed in brilliant greens and blues, with a large and very scarlet beak. Their favourite feeding tree, at present, seems to be a smallish shrub that bears scarlet flowers. Now this parrot is, on account of his brilliant plumage, one of the most conspicuous of creatures one can see in a day's march, yet when seen from above, feeding on his favourite bush, as I see him daily, he is extremely hard, often impossible until he moves, to pick out. His plumage looks exactly like, and tones down to, the colour of the foliage of the bush on which he is perched, and his scarlet beak against the green bushes looks just like a scarlet blob, such as the bushes own scarlet flowers appear to be. This is one of the many instances where we find a bird with a brilliant coat can make himself almost invisible by means of that brilliancy, and I believe such powers of concealment are possessed by 90 per cent. of animals, birds, &c., however brilliant their coats may be.

I think nature has provided each beast with a garb intended to conceal its wearer when seen before its common background. When we do see those owners it is generally under conditions, and against backgrounds, under which their colours could not, and probably were not meant to conceal. When walking through the grass lands and jungles how many butterflies and birds of brilliant plumage does one flush and on seeing them think how conspicuous they look in their lovely coats? But does one also realise that had those creatures not moved, but remained perched where they were, with their typical background behind them, one would have passed by in ignorance of their proximity? Thus I am sure that all garbs—however brilliant—worn by animals and birds are protective, when seen against their common backgrounds.

Birds and animals spend their lives in sleeping, eating and rearing their young. Most birds sleep at night, and for this period of their existence require no concealing coats. Similarly wild animals, although sleeping by day, do so well hidden away in thick sholas or cheddy, and so require no concealing garb. It must therefore follow that their protective garbs are designed to be pictures of their common background while engaged in feeding and the rearing of their young, as they are amply protected while sleeping. This certainly seems to be the case—for example, remember the case of the parrots that I have just described. Also as the female's chief concern, or concern that is particularly her own, is that of rearing her young, it may be that her colouring has been specially adapted to protect her and her young at such period and hence the difference, shown in most species, between the colouring of males and females.

In short there are exceptions to the ideas expressed here as to protectiveness depending on the possession of counter-shading and body patterns approximating to the background colour patterns of their owner, but they are exceptions that only go to prove the general rule. In every case where animals are not provided with counter-shading, nor body patterns, you will find that such animals are immune from attack from their neighbours on account of their enormous size, or harmlessness, and have no difficulty in providing for their own food without interfering with their neighbours, *i.e.*, elephant, rhino, hippo, bear (harmlessness) to other animals.

In conclusion I must add that I believe that the actual colour and type of body patterns worn by animals are influenced and governed by the colours and characteristics of the surrounding locality in which their owners live, combined with the force of natural selection among the animals themselves. It would be interesting to be able to compare, closely and carefully, the habitats of the North Indian and South Indian Black-Bucks respectively, and see whether the difference in coat colours worn by each breed of the same animal can be traced to difference of colour and character of their respective habitats.

DRAGONFLY COLLECTING IN INDIA.

BY

MAJOR F. C. FRASER, I.M.S., F.E.S.

PART III.

(With three text figures.)

(Continued from page 69 of this volume.)

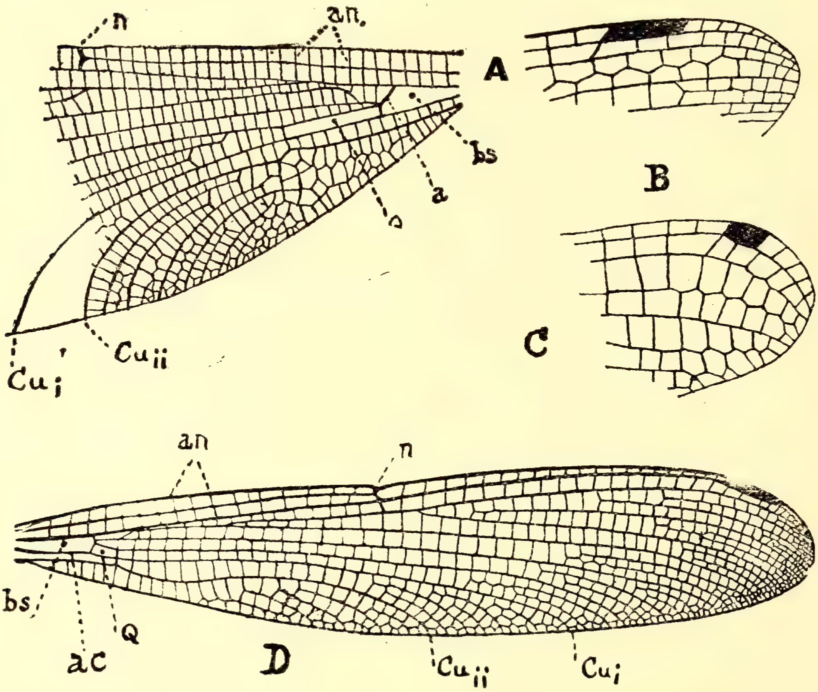


Fig. 1. A. Base of wing of an *Agrionine*. B. Apex of wing of a Lestine showing the elongated stigma. C. Apex of wing of a *Cœnagrionine* showing short quadrate stigma. D. Wing of an *Epallagine*.

a. The arc. *an.* The antenodal nervures *bs.* The basal space. *q.* The quadrilateral. *Cui* and *Cuii.* Two longitudinal nervures arising from lower angle of quadrilateral. *ac.* The anal crossing (Nervure *ac.*).

In *A* note that the quadrilateral is longer than the basal space and in *B* shorter. In *A* also note that the sectors of arc arise from below the middle of arc but in *B* from its middle.

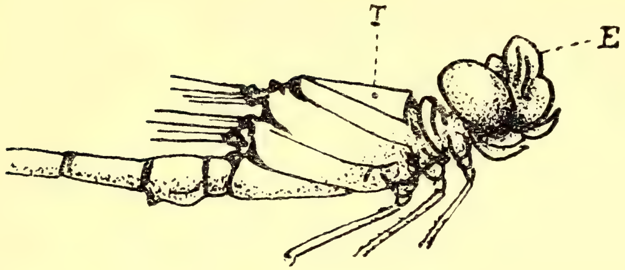


Fig. 2. A *Libellagine* viewed sublaterally showing the enormous development of the epistome. E. The epistome. T. The mesothoracic triangle. Note that the triangle extends here to the base of the wings. (See Key No. 223).

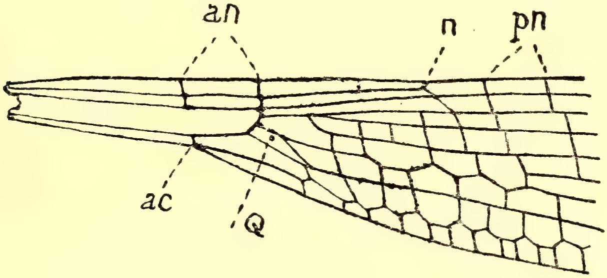


Fig. 3. Basal half of wing of a *Lestine* showing :—*an.* The two antenodal nervures. *pn.* Postnodal nervures. *ac.* An important nervure much used in classifying the *Cœnagrioninæ.*

CONTINUATION OF KEY WHICH INCLUDES THE SUBFAMILY *Agrionidæ* AND GENUS *Lestes* OF SUBFAMILY *Cœnagrionidæ.*

198. Family—*Agrionidæ*:—
Robust species with more than two antenodal nervures in all wings 199
Family—*Cœnagrionidæ*:—
Smaller and more slender species with only two antenodal nervures in all wings. 239

199 Subfamily—*Agrioninæ*:—
Stigma in the wing of both sexes, absent, false or much reduced. (Except in *Climacobasis.*) (A false stigma is traversed by transverse nervures.) Sectors of arc arising from lower third of arc; quadrangle convex anteriorly and as long as or nearly as long as the basal space 200

199.	Subfamily—*Epallaginæ* :— Stigma long and well developed in both sexes; sectors of arc arising from middle or above middle of arc; quadrangle rarely convex anteriorly and not as long as basal space	208
	Subfamily—*Libellaginæ* :— Same as last but the eyes much closer together; epistome enormously developed so as to form a nasal-like eminence on the face	221
200.	Genus—*Climacobasis* :— Stigma long and well developed in all wings	*Climacobasis modesta*.
	Stigma absent, false or much reduced	201
201.	Basal space entire	202
	Basal space traversed by one or more nervures	206
202.	Genus—*Vestalis* :— Stigma absent in both sexes; wings non-metallic	203
	Genus—*Mnais* :— Reduced stigma in the male, but small, irregular or absent in the female	205
203.	Wings brightly saffronated throughout	*Vestalis smaragdina.*
	Wings hayline, the apices tipped broadly with black	*Vestalis apicalis.*
	Wings hyaline, the apices not tipped with black	204
204.	Only one row of cells between nervures *Cui* and *Cuii*, except at the border of wings	*Vestalis amoena.*
	Two rows of cells between nervures *Cui* and *Cuii* from their origin	*Vestalis gracilis.*
205.	Venation reddish yellow, wings of male brightly saffronated	*Mnais earnshawi.*
	Venation black, wings pale greenish yellow	*Mnais andersoni.*
206.	Genus—*Neurobasis* :— Stigma absent in the male, a false white one in the female. Hindwings of male blue or green metallic and black tipped. A white spot on node of wings in the female	*Neurobasis chinensis.*
	Genus—*Matrona* :— All wings in both sexes opaque black, stigma absent in the male, white and reduced in the female	207
	Genus—*Echo* :— Outer third of all wings in both sexes opaque black; stigma white in both sexes	*Echo margarita.*
207.	Thorax marked underneath with yellow; nervures at base of wing finely white	*Matrona basilaris.*
	Thorax unmarked beneath with white; nervures at base of wings black, the apices of wings paler	*Matrona nigripectus.*

208.	Quadrangle entire		209
	Quadrangle traversed		214
209.	Not more than 14 antenodal nervures in the forewings		210
	More than 14 antenodal nervures in the forewings		211
210.	Genus—*Philoganga* :—		
	Wings stalked as far as the nervure *ac*; resting with the wings held wide open	*Philoganga montana.*	
	Genus—*Epallage* :—		
	Wings practically unstalked; resting with wings close together over back	*Epallage fatime.*	
	(*P. montana* is from Assam *E. fatime* from Kashmir.)		
211.	Genus—*Anisopleura* :—		
	Costal margin of hindwing of male with a marked angular projection near its base		212
	Genus—*Bayadera* :—		
	Costal margin of hindwing of male straight		213
212.	Superior anal appendages of male with a downwardly directed spur	*Anisopleura lestoides.*	
	Superior anal appendages of male without any spur, flat, broad and overlapping	*Anisopleura comes.*	
	Superior anal appendages of male without any spur, subcylindrical	*Anisopleura furcata.*	
213.	Apices of wings hyaline	*Bayadera hyalina.*	
	Apices of wings tipped with black	*Bayadera indica.*	
214.	Genus—*Caliphœa* :—		
	Not more than 12 antenodal nervures in forewings; back of throax and end of abdomen pruinosed white	*Caliphœa confusa.*	
	Genus—*Pseudophœa* :—		
	More than 12 antenodal nervures in forewings; base of throax and end of abdomen never pruinosed with white		215
215.	Abdomen red; hindwings tipped broadly with black		216
	Abdomen black; hindwings variable		217
216.	Hindwing much shorter than forewing and rounded at the tip; a pair of bright blue dorsal stripes to thorax	*Pseudophœa fraseri.*	
	Fore and hindwings of nearly the same length, the hind not markedly rounded at the tip; no blue stripes on thorax	*Pseudophœa dispar.*	
217.	Hindwing of male metallic blue or green		218
	Hindwing of male non-metallic, enfumed, black or orchreous		219
218.	Hindwings of male metallic purplish blue.	*Pseudophœa carissima.*	
	Hindwings of male metallic green	*Pseudophœa splendens.*	
	(Both these species are from Ceylon only.)		
219.	Wings of male opaque black	*Pseudophœa masoni.*	
	Wings of male saffronated or enfumed		220
220.	Wings of male brownish yellow throughout	*Pseudophœa brunnea.*	
	Wings of male brightly saffronated but only palely so in the apical half of forewings.	*Pseudophœa ochracea.*	

220.	Wings of male enfumed throughout. (Coorg only)	*Pseudophæa etheli.*	
221.	Genus—*Rhinocypha* :—		
	Quadrilateral traversed more than once		222
	Quadrilateral traversed only once		236
222.	Species found only in South and Central India. Wings very narrow, the apical third opaque, this area in the hindwing with a single large vitreous spot	*Rhinocypha bisignata.*	
	Species not found as far south as Central India		223
223.	Dorsal mesothoracic triangle extending nearly to root of wings		224
	Dorsal mesothoracic triangle extending only halfway to root of wings		230
224.	Hindwings of male with opaque bands		225
	Hindwings of male largely opaque, with vitreous spots		227
	Hindwings of male colourless, no opaque areas	*Rhinocypha immaculata.*	
225.	Hindwings of male with 3 opaque bands, one at apex of wing, one at node and a third midway between these		226
	Hindwings of male with only two opaque bands, the nodal band being absent	*Rhinocypha bifasciata.*	
226.	Bands on wings connected up along the anterior and posterior borders of wings so as to enclose two large vitreous spots.	*Rhinocypha bifenestrata.*	
	Bands on hindwings not connected up	*Rhinocypha trifasciata.*	
227.	Apical vitreous spot always approaching to within two rows of cells of the costal margin of wing	*Rhinocypha cuneata.*	
	Apical vitreous spot never less than four cell-rows from the costal border of wing.		228
228.	The posterior hyaline border of forewing occupying about half its breadth	*Rhinocypha spuria.*	
	The posterior hyaline border of forewing occupying only about one-fifth of the breadth of wing		229
229.	Vitreous spots small and very clearly defined, the apical spot exactly under the stigma, the middle band of spots made up of three spots only, posterior hyaline border of forewing very narrow	*Rhinocypha quadrimaculata quadrimaculata.*	
	Similar to the last but the posterior hyaline border of forewing occupying about half the breadth of wing	*Rhinocypha quadrimaculata hemihyalina.*	
	Vitreous spots large and irregular, the apical one proximal to or only slightly overlapping the stigma, middle row of spots made up of four	*Rhinocypha quadrimaculata fenestrella.*	
230.	The greater part of wings opaque; hindwing moderately broad		231

230.	Only the outer half or less of the wings opaque; fore and hindwings very narrow	233
231.	Hindwing with 3 vitreous spots in the middle, the median one of which is nearest apex of wing and lies between the horns of a strongly curved apical vitreous band	*Rhinocypha iridea.*
	Hindwing with a single large spot of vitreous situated about the middle of wing. Very large species	*Rhinocypha unimaculata.*
	Wings fiery coppery; hindwing with a medial row of vitreous spots	232
232.	Small form, hindwing 23 mm or less; vitreous spots short	*Rhinocypha trimaculata.*
	Larger form, hindwing 26 mm or more; vitreous spots long	*Rhinocypha ignipennis.*
233.	Only the apical third of wing opaque	234
	The apical half of hindwing opaque	235
234.	A row of vitreous spots in the dark area of wing, a second row in the hyaline area adjacent to it and a long vitreous streak about the middle of wing	*Rninocypha beesoni.*
	Similar to the last but the vitreous streak wanting	*Rhinocypha biforata.*
235.	Opaque area of forewing prolonged inwards along the costal border; posterior apical borders narrowly hyaline	*Rhinocypha perforata whiteheadi.*
	Opaque area of forewing not prolonged inwards along costal border; no hyaline border to hindwing	*Rhinocypha perforata perforata.*
236.	Genus—*Libellago*:— Male with a well developed stigma in forewing; antenodal nervures 16 or more in number	*Libellago asiatica.*
	Genus—*Micromerus*:— Male with the stigma absent in forewing; not more than 6 antenodal nervures in wings	237
237.	Abdomen 14 mm or less in length, markingsyellow; only 5 antenodal nervures.	*Micromerus lineatus.*
	Abdomen 17 mm or more in length; 6 antenodal nervures in forewing	238
238.	Hindwing of male colourless; apex of forewing with the black tip 4 mm wide	*Micromerus blandus.*
	Hindwing of male dirty yellow; apex of forewing with the black tip more than 6 mm wide	*Micromerus finalis.*
239.	Subfamily—*Lestinæ*:— Stigma narrow and elongate, similar to that of the *Libellulinæ*. Most species resting with the wings wide open	240
	Stigma very short, diamond shaped or squarish. All species resting with the wings folded close together over the back	258

240.	Genus—*Megalestes* :—		
	Very large species with abdomen 50 mm long	*Megalestes major.*	
	Smaller species with abdomen not more than 40 mm long		241
241.	Genus—*Orolestes* :—		
	Wings marked with broad black fasciæ	*Orolestes selysi.*	
	Wings quite unmarked		242
242.	Genus—*Lestes* :—		
	Quadrangle of fore and hind-wings of the same size and shape		243
	Genera—*Lestes, Indolestes* and *Sympycna*:—		
	Quadrangle of fore and hind-wings differing, the hind much narrower and longer than the fore		249
243.	Stigma twice or more than twice as long as broad		244
	Genus—*Platylestes* —		
	Stigma not twice as long as broad	*Platylestes platystyla.*	
244.	Thorax without any thoracic dorsal metallic markings		245
	Thorax with metallic dorsal stripes		246
	Thorax almost entirely bronze green		248
245.	Thorax brown; stigma uniform pale brown	*Lestes umbrina.*	
	Thorax green; stigma dark brown, its outer part paler	*Lestes thoracica.*	
	Thorax brown; stigma longitudinally bicolorous, dark brown and light brown; abdomen peppered with black	*Lestes nodalis.*	
246.	The metallic green stripes on back of thorax narrow and of even width throughout; head unmarked with black	*Lestes viridula.*	
	The metallic green bands on back of thorax narrow and of even width throughout; head black above, whitish behind	*Lestes nigriceps.*	
	The metallic green bands on back of thorax with an outward lateral hook-like expansion above	*Lestes elata.*	
	The metallic green bands on back of thorax with two outward lateral hook-like expansions, one above and the second at the middle		247
247.	Abdomen 40 mm in length, segments 8 and 9 entirely black, the 10th all blue	*Lestes præmorsa dorothea.*	
	Abdomen only 32 mm in length, segments 8, 9 and 10 with blue markings on the sides	*Lestes præmorsa præmorsa.*	
	Abdomen about 30 mm in length and marked similarly to the last; thorax pruinosed bluish white	*Lestes præmorsa decipiens.*	
248.	Stigma with basal half brown, apical half white	*Lestes barbara.*	
	Stigma unicolorous—yellowish; dorsum of thorax with dorsal and shoulder stripes of yellow	*Lestes orientalis.*	

249.	Species resting with the wings wide open; ground colour blue marked with bronzed black		250
	Species resting with the wings held close together over the back; colour pale brown with darker brown or black markings (except *Indolestes pulcherrima*)		253
250.	Tibial spines short, those of the hind leg hardly as long as the claws of the same foot (North India)	*Lestes cyanea.*	
	Tibial spines long, those of the hind leg longer than the claws of the same foot (South India.)		251
251.	Front of thorax bronze black, behind which follows a complete black stripe	*Lestes gracilis birmanus.*	
	Front of thorax bronze black, behind which follows a chain of two or three black spots		252
252.	Top of head black; 1st abdominal segment with a black basal spot not extending to the apex of segment	*Lestes gracilis gracilis.*	
	Top of head black; 1st abdominal segment with a black spot which extends from base to apex of the segment	*Lestes gracilis divisa.*	
253.	Genus—*Sympycna* :— Hinder margin of prothorax trilobed in the female	*Sympycna pœdisca.*	
	Genus—*Indolestes* :— Hinder margin of prothorax in the female simple		254
254.	Ground colour azure blue; a single broad middorsal metallic band on thorax	*Indolestes pulcherrima.*	
	Ground colour palest brown		255
255.	Abdomen only 24 mm in length; dorsal bands on the 2nd abdominal segment broadest at the base and entirely coalescent except at the apex of segment	*Indolestes buddha.*	
	Abdomen 30 mm in length or more		256
256.	Dorsal bands on 2nd abdominal segment incomplete at the middle of segment, the basal parts coalescent, the apical separated or also coalescent	*Indolestes indica.*	
	Dorsal bands complete		257
257.	Stigma only twice as long as broad; dorsal bands on 2nd abdominal segment coalescent at a point only near the base or entirely separated	*Indolestes bilineata.*	
	Stigma three times as long as broad; dorsal bands on 2nd abdominal segment coalescent only for a short space at the apex of segment where they enclose a small spot of the ground colour	*Indolestes helena.*	
	Stigma four times as long as broad; dorsal bands on 2nd abdominal segment separated for their entire length	*Indolestes veronica.*	

(*To be continued.*)

THE FISH SUPPLY OF OUR WESTERN COAST.

Being extracts from and comments on the "Report on the Work of the Steam Trawler 'William Carrick'," by A. E. Hefford, Marine Biologist (published by the Government of Bombay).

By the Editors.

(*With Map and one plate.*)

THE WORK OF THE STEAM TRAWLER "WILLIAM CARRICK."

How many of us ever trouble to read Government publications ?—Are they not, like Dr. Dryasdust's introductions to the Waverley Novels, forbidding at first sight ? Yet many will repay one for more than a casual glance and what a loss we should have suffered if we had been disheartened by Dr. Dryasdust? No—we are not instituting a comparison of Government publications in general nor the story of the "William Carrick" in particular with the works of Sir Walter Scott, but we wish to draw attention to the story of the work performed by the Steam Trawler "William Carrick" off the coast of Bombay.

As Mr. R. D. Bell, the Director of Industries, points out in his introduction to the Report, the scheme for employing a steam trawler to investigate the possibilities of developing the fisheries of our Indian Seas was first taken in hand just after the armistice when the world was enjoying a boom. This made the purchase of the vessel, which was one of the many vessels built during the war, expensive. She was of the type known as the "Castle" class of steam trawler, in the design of which consideration was given not only to the requirements of the war but also to the question of subsequent utility for fishing purposes.

Mr. Bell writes : "Once the experiment had been launched at considerable expense, the logical and scientific course was to carry it on for a full calendar year, so that a complete season's data should be available for the promoters of such ventures in the future when market and other conditions had improved. Logic and science were, however, too expensive for the time being, and the experiment had to be wound up before the new financial year began.

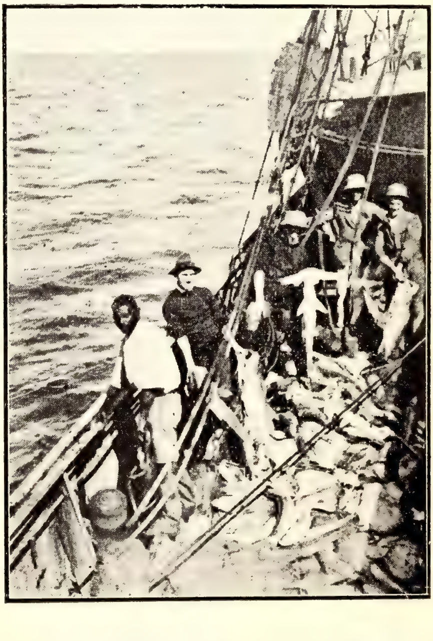
"One important change in conditions has since occurred, the installation of cold storage at the local market. This has encouraged private enterprise to make another effort."

Earlier in his introduction he states that the enterprise was approved by business men. What were these business men about that they did not realise that without cold storage in Bombay and without railway refrigerating vans, steam trawling could not pay. Surely cold storage must be provided first, and from the commercial point of view they were putting the cart before the horse. Apart from this, however, from the commercial point of view a steam trawler of the size of the "William Carrick" making infrequent and irregular returns to Port could not pay even were cold storage provided. The need from the commercial point of view is for small motor fishing boats equipped with all the gear for deep-sea seining and drifting which would, thanks to their speed and independence of wind, be able to visit fishing grounds too far away for native sailing craft and which again in consequence of their speed could return to port in time for the morning market. On such boats there would be no necessity for a refrigerating plant. How different to the state of affairs on the "William Carrick." Mr. A. E. Hefford, the Marine Biologist, who was in charge, writes:—

"More than the ordinary reconditioning was necessary in order to meet special requirements for fishing in tropical seas. The most important matter in this

Mending the trawl net.

The "cod end" of the trawl hauled inboard. It is about to be untied to let out the catch of fish into the deck pond.



A mixed catch. The fish being held up are (from front to rear) goal, hammer-headed shark and ravas.

(*Reproduced from the "Report on the Operations of the Steam Trawler William Carrick" issued by the Department of Industries with the Government of Bombay.*)

connection was the provision of a refrigerating plant to produce a low temperature in the fish-hold, and the addition of a special wall of insulating material around the fish-hold so as to conserve the low temperature of this compartment."

The demand for fish in Bombay City alone and the difficulty of obtaining it under present conditions surely warrant another trial of the commercial possibilities of European methods of fishing and marketing in India, but when these trials are made we hope whoever undertakes them will be guided by the advice of experts in this country, who know Indian conditions and what is wanted for India, rather than by the advice of home experts who know nothing of Indian conditions, which is we fear what happened in the case of the "William Carrick".

The criticisms made however have little to do with the story. Let us proceed with this and in due order. Mr. Hefford marshals his facts well and, realising that if one knows nothing of a subject one is bored by technicalities, proceeds to explain right away the fishing methods known as trawling.

TRAWLING.

He writes :—

"The trawl is a large net made in the form of a conical bag with projecting wings on each side which serve to increase the width of its mouth. It catches fish by being dragged along the bottom of the sea from a moving ship. Like all fishing gear—or for that matter any other implement designed and utilized by man—it has been subject to a process of evolution in the course of its history and has become a progressively more efficient instrument for reaping the harvest of the sea. It has a general resemblance to the Dol and Bokshi which are used by the fishermen of Bombay Presidency. But the fundamental difference is that these are stationary nets which are fixed to stakes or to some other sort of mooring and are set so as to capture fish which swim into them—a method which may be compared with the setting of the spider's web for the capture of insects. The trawl, on the other hand is an *actively moving* instrument. It goes after its prey blindly in a sense but guided by the intelligence of the skipper who directs the movements of the vessel from which it is towed. The advantages of the mobile method over passive and stationary tactics are obvious ; but, of course, they are only obtained at a cost. Trawling calls for the exertion of power. The earliest types of trawler were sailing vessels which derived their power from the wind, the help of the tides also being utilized to some extent. With the utilization of the greater and more uniformly acting power afforded by the adoption of steam there was acquired not only a greater degree of mobility but also the ability to work bigger and more efficient trawlers. An early, but by no means an obsolete, type of trawl has its mouth kept open by a beam of wood to which are fixed—one at each end—a pair of D shaped iron runners which act as ' skids.' This sort of gear is known as the *beam trawl.* Such a net is limited in size by the fact that it is impracticable to work with a beam longer than about 50 feet.

"A stage of very marked improvement was achieved by the invention of what is known as the *otter trawl.* In this form of gear the cumbersome beam is done away with and the mouth of the net is kept open by the ' sheering ' action of a pair of strong wooden rectangular boards. These *otter boards,* as they are called, are fixed one on each side of the mouth of the net and to each is attached a rope by which they are connected to the ship (the trawler) by which they are towed in fishing. On a commercial trawler these ropes are of steel wire 2¾″ in circumferences and necessarily of great strength to withstand the immense strain to which they are subjected. They are known as the *trawl warps.* The attachment of net and of warp to each board of the pair is so arranged that the board acts as a sort of kite. As it is pulled at a slight angle through the water, the reaction of the board to the pressure produces a steady pull on the mouth of the net which keeps it open. The advantages of the *otter* over the *beam* method are that it enables a bigger net to be used, thus increasing the catching power. Besides allowing the use of a more widely spreading net the upper edge of the mouth of the net is also lifted into a wider gape.

"The size of a trawl is given by the length of head-rope or head-line which forms, so to speak, the upper lip of the mouth of the net. The largest modern steam trawlers use a trawl with a head-line of about 130 feet in length. When the net is fishing the head-line assumes the shape of a low backwardly directed arch.

" The actual width of the mouth of the net when fishing is estimated at about $\frac{2}{3}$ the length of the head-line. The lower lip of the trawl mouth consists of the ground rope which is heavier and thicker than the head-line because of the greater wear to which it is subjected in being dragged along the sea bottom. It is also made longer than the head-line and, therefore, when fishing it trails along with the greater part of its curve below and in rear of the head-line. This arrangement makes more certain the capture of fish which would have a good opportunity of eluding the mouth of the net if the bottom-disturbing ground rope were not preceded by the head-line and the over-spreading ' square ' * of the trawl.

" The deck equipment of the trawler is adapted for the rapid and convenient lowering and raising of the net to the required depth and for the safe towing of the gear. Chief among these deck fittings is the winch on the twin drums of which the two steel wire warps are wound as on a huge reel. The power for the winch is provided by steam from the ship's boiler as in the case of an ordinary windlass. Each drum can be put in or out of gear separately and powerful brakes are provided for checking the warps when sufficient length of wire has been paid out. Other essential accessories are the sheaves or large steel pulleys which provide convenient leads for the warps from the winch to the ship's side when towing or hauling the net. These are so arranged that the warps can be led to either side of the vessel. Two nets are always provided, each attached to its pair of otter boards, so that when one is damaged or otherwise put out of action the warps can be quickly connected up with the reserve trawl ready on the other side. In order that the nets may be raised well clear out of the water each warp is led through a sheave (a large pulley wheel) which is fixed at a height of 7 or 8 feet above the deck level on a structure known as a ' gallows.' There is a forward and an after gallows on each side of the vessel.

" When a trawler is about to engage in fishing operations the winch brakes are released and the net lowered away until a suitable length of warp has been paid out (which varies according to the depth of water) while the vessel is manœuvred so that the net will sink clear of the ship and its propellor. This is effected by steering so that the wind will blow the vessel in the direction away from the side from which the net is lowered. Failing the assistance of the wind it is necessary to take advantage of the tide so that the net may drift clear with the current. This operation, usually termed ' shooting ' the trawl, calls for skill and judgment on the part of the skipper and smart handling on the part of the men at their several stations where each has his special job *to be done at the right moment.*

" After the trawl has been towed for a suitable time, which in commercial practice usually varies from 4 to 6 hours, the word is given for hauling. The first operation is the release of the ' towing block ' by means of which the two warps are drawn together on the outside of the bulwark on the ship's quarter. The winch is then set in motion and the otter boards are hauled up to the gallows. The wings are then drawn in by means of 'quarter ropes', the power for this also being provided by the steam winch. The front part of the net is hauled in by hand, the whole of the deck crew being assembled for this purpose, till the narrow hinder part of the net known as the ' cod end', in which most of the captured fish are collected, is reached when a rope sling (called a ' becket ') is passed around it and the ' bag ' is lifted up overside and led in board by a steel wire rope which passes round a sheave attached to the mast head. As the bag is suspended over that part of the deck separated off for the purpose, the rope by which the extremity of the net was securely closed while fishing is unfastened and the catch falls into the ' fish pound ' which is a rectangular area of deck space separated off by strong wooden planks fixed into short upright iron brackets."

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* The foremost and widest part of the top side of the trawl.

THE CREW.

Mr. Hefford next deals with the question of crew and, after describing the duties of the 31 members of the crew and adding to these himself, the Assistant Marine Biologist, and a personal servant, making a total of 34, which he considers " a somewhat large crowd to be carried by a vessel the sister ships of which working from British fishing ports normally carry a crew not exceeding 10 or 11 in number", he bears out our contention that the " William Carrick " was too large for commercial purposes by his comment. " The necessity of carrying so large a crew for trawling from the port of Bombay constitutes the first handicap that may be noted in connection with the question of industrial trawling in these parts".

OBJECTS OF THE WORK.

We give here Mr. Hefford's own words, *verbatim* :—

" Before describing the fishing operations of the ' William Carrick ' it is necessary to make some reference to the aim and policy which it was decided should be followed in conducting the work.

" In the Annual Report of the Department of Industries for 1918-19 (when the acquisition of a trawler was originally decided upon), Mr. Bell, the Director of Industries, wrote as follows :—

' This is a field for Government endeavour analogous to the exploration of the country's mineral resources by the Geological Survey of India. In the case of fisheries, however, I consider that mere exploration work should, at the outset, be subordinated to the policy of ascertaining definitely whether trawling will or will not pay in Bombay waters.' It was not without careful reconsideration after the arrival of the trawler that this policy, under which our primary object was to catch and market as much fish as possible, was embarked upon. All that was involved by this will become more apparent at a later stage in this report when the details and results of the work have been described. That a steam trawler, albeit, an ' experimental trawler,' which is a practical industrial machine should be used in a practical industrial way and the results of its operations judged in the inequivocal commercial units of rupees expended and realised appears on the face of it to be the right way of regarding such an undertaking. That there is another point of view will, possibly, be made clear later on. Otherwise this report might be closed here and now with the statement that our balance sheet shows a very considerable excess of expenditure over income ; in a word, that the working of the steam trawler did *not* pay.

" Fishing has a unique character which separates it from all other industrial pursuits. Manufactures depend principally for success upon the efficient and economical working of processes for rendering raw materials into goods which can be marketed at a profit. Agriculture involves the possession of land, the utilization of seeds, manures and implements and the expenditure of labour over a shorter or longer period before crops can be harvested. Mining operations are dependent first upon the acquisition of that part of the earth's crust that is to be opened for the extraction of its subterranean mineral wealth. The deep sea fishermen, on the other hand, pay no rent or royalty ; and, except those imposed by Nature, there are no boundaries to the fields open to their exploitation. Nature looks after the propagation of their stock and all they have to provide are the craft to go out in and the fishing gear to work with. Their harvest time is, or could be, an all-the-year-round one. With so much to the good there are nevertheless plenty of difficulties. The scope of their harvesting is limited by the power and sea-worthiness of the craft in which they go out on the great waters and by their skill and hardihood as sea-farers, and, most important point of all, the fish which are the objects of their search are not definite and stationary objects. They may be here to-day and gone to-morrow. However, though there may be some scope for guess work on the part of even the most experienced in fishing lore, the fact is that deep-sea fishing is by no means the blind and chancy pursuit that it would appear to the inexperienced landsman. Just as certain crops naturally flourish on certain soils, and just as certain strata below the earth's surface are known by the geologist to contain particular minerals or to yield supplies of water, so the fish life which moves and has its being in mysterious obscurity in the depths of the sea necessarily bears a natural relationship to its environment. This presence or absence of fishes is determined by perfectly definite natural conditions. The depth, temperature or salinity of the water, the nature of the bottom, the weather conditions, the state of tide, the time of day (light or darkness) and the season of the year, associated with the specific habits of the fish relative to their search for food or their reproductive instinct—some or all of these conditions may operate as factors in determining the movements of fishes which are subject to natural laws like every other organism.

" In European seas the researches of marine biologists have gone very far towards the elucidation of the operation of these laws so that the life history of some of the important food fishes is comprehended from the stage of the passively drifting embryo in its floating egg to the stage at which in due course the mature adult finds its way to the area marked out by natural law as the spawning ground of the species.

" Naturally the fisherman is fundamentally interested only in that part of fish lore that will enable him to know when and where he can go with a reasonable prospect of making good catches of fish. He thus becomes a keen investigator of fish migrations, though his methods are empirical and he does not bother his head about casual factors, or if he does he is apt to make rather unscientific assumptions about them.

" The point to which all the foregoing is intended to lead is that while the fisherman is occupied in catching fish for the market he is also occupied in accumulating knowledge about the movements and distribution of fishes. In an area which has been fished for many years and possibly for many generations the fishermen of to-day has the benefit of the discoveries and experience of his elders to guide him in his quest, but after a certain point it is the use he makes of his own experience and observations which most of all places him—or unplaces him —in the competition against other fishermen. Luck or chance certainly comes into the case, but as in games of cards it is the skilful player who makes use of previous experience and whose memory, observation and reasoning powers are most acute who wins through in the long run. This rule applies to all kinds of fishing but probably to trawling most of all, because it is essentially a *mobile* and therefore initiative demanding method. It is clear then that while the trawler skipper is capturing fish which have a present market value he is also, making, and, with more or less accuracy and rationality storing in his memory, observations which have a potential value leading to subsequent profit or guarding against future loss. These are the skipper's ' trade secrets ' and very exceptionally are they shared with competing brethren in the trade; for knowledge in the trawling industry has an extraordinarily high value in proportion to other capital requirements of the trade.

" The trawler ' William Carrick ' was a pioneer with a virgin field for exploration before her. When we started we had no experience and no information to go upon except such as could be gathered or inferred from the observed results of the operations of local inshore fishermen; and it was not in our programme to intrude upon their grounds. It is obvious that such circumstances involve the smallest chances for the best market results in the early stages of the enterprise. On the other hand, starting as one did with a *zero* fund of information, the exploration aspect of the work possessed a high degree of value and of interest. There was indeed a good deal to be said for concentrating on the exploratory side of the undertaking, spending as much time as possible at sea, traversing as much ground as possible, making a large number of hauls—' sample ' hauls of short duration—and leaving market considerations in the back-ground. This course would have yielded more *information* about the distribution of the various kinds of fish, and if it had been followed there would have been more *body—i.e.*, more and better systematised facts about the distribution of fishes and its local and seasonal variation in these waters—in the present report. However the market for trawled fish was also an important matter for exploration. And there was also the consideration that results expressed in terms of rupees would carry more significance and convey more meaning than results expressed in terms of fish*. Moreover the Monsoon season was at hand—we commenced our first voyage on the 17th of May—when there would be a great lack of fish from other sources, since the local machliwallas cannot put to sea in very stormy weather, and when it was also considered not desirable for the ' William Carrick ' to wander too far from port.

" After the first three trips (17th May to 1st June 1921) during which the gear and crew became adjusted to working conditions and a tentative trial of various grounds was made, the policy of working on commercial lines was given the fullest scope, Skipper Reeve being left in sole control of the working movements of the ship to decide when and where and how long to trawl exactly as if he were following his calling as master of a commercial trawler working for the fish market of Grimsby or Fleetwood. The Marine Biologist (the present writer) or (in the earlier voyages) the Superintendent of Fisheries (Mr. T. J. Walke), or both, went out on the trawler for the purpose of recording the kinds, quantities and circumstances of capture of the fish taken in the trawl.

" On the 10th of October 1921 the Director of Industries placed the control of the trawling in the hands of the Marine Biologist.

" On the 25th November orders were received which implied a change of policy. Up to this date the primary consideration had been to get fish for the market, cruises of a mere exploratory nature had been debarred, and mere recording, not researching, had been the main occupation of the Marine Biologist at sea. Orders were now received to the effect that the trawler should be worked so as to obtain as much information as possible, the supply of fish to the market becoming a secondary consideration. The primary object was to get in as many working days at sea as possible. It may be mentioned that Bombay market was at this time being well supplied with fish so that the proceeds of our sales were more than ever disproportionate to the working expenses. No change was made in the fishing procedure, as by this time the practice of making three hauls each of 3½ hours' duration during daylight and two 5½ hours' hauls during the night had become established as a routine which, while it afforded the practicable maximum of time for the trawl to be in the water (fishing), also fitted in with the requirements of the crew, both officers and men, as regards the changing of watches and the times for food and sleep. For the purpose of obtaining the most in the way of information-yielding records a system of seven or even six 3-hour hauls each day would have been better than the other, but the human element had to be considered.

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* This was *not* the writer's (Mr. A. E. Hefford) opinion.

"The new dispensation however permitted us to go off and explore the distant grounds to the North-West, and especially the reputedly very rich fishing grounds off the Sind coast, which we visited in December 1921, January 1922, and for our final voyage before laying up at the end of February 1922. Previous to this, with the exception of a visit to the neighbourhood of Karwar in October 1921 (voyage XIX), we had confined our fishing for the most part to grounds within a few hours steaming from Bombay."

AREA OF OPERATIONS.

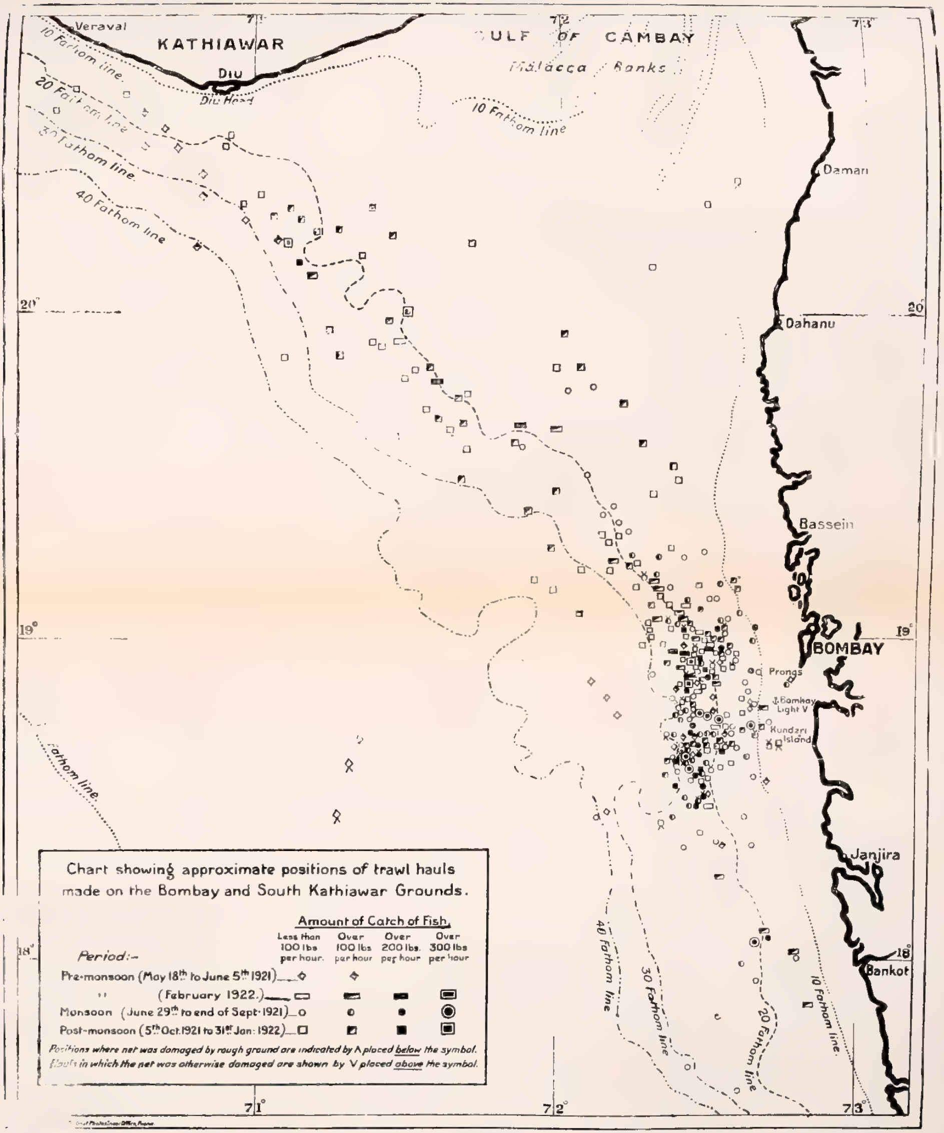
Mr. Hefford writes :—

"The limits of the areas over which fish catchable by the trawl are distributed and the abundance in which they occur in different parts of such areas were at the outset of our undertaking circumstances about which our information was very limited. The discovering of the limits of distribution of trawl fish and its relative abundance in different localities was in fact an important——though secondary—object of the enterprise.

"In the fisheries of the North Atlantic and its associated seas the trawling method is practised from shallow inshore areas of a few fathoms depth up to, and even occasionally beyond, the 300 fathom line. Large steam trawlers using the otter trawl as a rule are rarely to be found working in less than about 15 fathoms, such inshore shallows being mostly fished by sailing craft of comparatively small tonnage using the beam trawl which is a more manageable form of gear for shoal water than the commercial otter trawl. Trawling in the great depths of 100 fathoms or more is practically limited to the steam trawlers from the large fishing ports on the West Coast of England which go in pursuit of the hake (*Merluccius vulgaris*) on the edge of the ocean depths on the east side of the Atlantic. Probably over 75 per cent. of the fish caught by all the trawlers in the world is caught between the depths of 15 and 80 fathoms.

"If one looks at a chart of the Arabian Sea off the Bombay Presidency it will be evident that the virgin field awaiting exploration, and possibly exploitation, consisted of the zone bounded on its landward side by the narrow coastal strip which is already more or less exploited by the long established fishermen of the coastal communities by methods which have been practised for many generations and the fish stocks of which are thereby already known—at least to the fishermen themselves. On its seaward side it is bounded by the contour of depth up to which a trawl can be conveniently operated. This outer boundary may be considered to be the 100 fathom line ; for although, as has been mentioned above, trawling is carried on at over twice this depth in the Atlantic Ocean, the part of the sea bottom lying beyond the 100 fathom line of the West Coast of India slopes so steeply down to the great ocean depth of 1,000 fathoms or more where, even if the fish occurred, trawling would be quite impracticable, that there is so little distance between the 100 fathoms and the 200 fathom lines that if the latter contour were taken as the limit it would make no appreciable difference to the area enclosed.

"A glance at the chart will show that the zone between the coast and the 100 fathom line is a relatively narrow strip on this side of the Arabian Sea. Off the coast between Karwar and Vengurla this line lies only about 45 to 55 miles from the coast. Coming northward one finds the area of comparatively shallow water extending progressively further out to sea. Off Ratnagiri the 100 fathom line is 65 miles from land and off Bombay the distance is rather more than 120 miles. This depth contour continues in a generally north-westerly direction which brings it furthest from land abreast of the Gulf of Cambay and it again converges into nearer proximity off the west coast of Kathiawar. Off Navibunder its distance is only about 45 miles and off Dwarka about 60 miles. Thence this contour line proceeds roughly parallel to the Kutch and Sind coast at a distance


Veraval
KATHIAWAR
Diu
Diu Head
GULF OF CAMBAY
Malacca Banks
10 Fathom line.
20 Fathom line
30 Fathom line.
40 Fathom line
10 Fathom line
Daman
Dahanu
Bassein
BOMBAY
Prongs
Bombay Light V.
Kundari Island
Janjira
Bankot
Fathom line.
40 Fathom line
30 Fathom line
20 Fathom line
10 Fathom line.
71°
72°
73°
20°
19°
18°
Chart showing approximate positions of trawl hauls made on the Bombay and South Kathiawar Grounds.
Amount of Catch of Fish.
Less than 100 lbs per hour.
Over 100 lbs per hour
Over 200 lbs. per hour
Over 300 lbs per hour
Period:-
Pre-monsoon (May 18th to June 5th 1921)
" (February 1922.)
Monsoon (June 29th to end of Sept. 1921)
Post-monsoon (5th Oct. 1921 to 31st Jan. 1922)
Positions where net was damaged by rough ground are indicated by Λ placed below the symbol.
Hauls in which the net was otherwise damaged are shown by V placed above the symbol.
Govt Photozinco Office, Poona.

(Reproduced from the "Report on the operations of the Steam Trawler William Carrick" issued by the Department of Industries with the Government of Bombay.)

of 60 to 80 miles. Along the Baluchistan coast, the shallow water zone is very narrow, the average distance of the 100 fathom line being about 14 miles; and at only twice that distance from the coast the ocean depth of 1,000 fathoms can be reached."

THE FISHING GROUNDS.

Mr. Hefford is very interesting here:—

"The nature of the bottom below the sea is of fundamental importance in determining the occurrence of fish life. Excepting the cases where fish migrate for spawning purposes to particular areas which are specially adapted for this in virtue of physical conditions of water or bottom or in relation to the localities where the young fry can find a living, the distribution of fishes depends directly upon the occurrence of suitable food supplies. Without going into detailed consideration of the biological points involved, it may be said here that the kinds and quantities of marine animals which constitute the bottom fauna depend very largely upon the physical character of the bottom. It would be more accurate to say that their occurrence is naturally correlated with the character of the sea bottom; because certain conditions which determine the nature of the bottom also determine the conditions of life of the fauna. It thus comes about that mud, fine sand, coarse sand, shelly ground, stony or rocky ground each has its characteristic fauna for the reason that different types of animals have their own characteristic structure and habits by which they are adapted to the physical environment in which they are found. It is obvious that the presence or absence of the fishes which feed upon these animals which dwell on or near the sea bottom will be profoundly affected by the abundance of such prey and will thus indirectly be correlated with the nature of the bottom.

"The sea bottom of the Bombay Presidency from close proximity to the shore out to and beyond the 100 fathom line consists almost entirely of dark grey clayey mud. This layer of mud, which is probably of considerable depth, is the accumulated sediment of land—derived material which has been washed from the land surface by the rains and carried away by rivers and streams for countless ages. This vast expanse of submarine mud by virtue of its characteristic fauna dominates the whole region in a fishery sense. Here and there among the almost universal expanse of mud are to be found patches of sand, frequently associated with broken shells but very rarely free from a greater or less admixture of mud. They are of relatively insignificant extent and occur for the most part between 30 and 100 fathoms. Of more frequent occurrence are patches of coral which probably in most cases mark the places where a mass of rock protruding through the layer of mud affords a lodgement for the colonies of organisms which build up these particular organic reefs. It was our experience that patches of sandy ground were also associated with coral formations. It goes without saying that a trawl towed over a mass of coral comes to grief. Coral is not as a rule met with in this neighbourhood at depths of less than 40 fathoms but there is a possibility of meeting it anywhere over 30 fathoms; and in the neighbourhood of Okhamandal and Kutch it occurs at depths between 20 and 30 fathoms.

"There are patches of rocky ground at various places not all of which are charted. These are obviously spots to be avoided by a trawler.

"As might be expected, the extent of the purely muddy grounds is greatest off that part of the coast where rainfall is heaviest and the torrents therefore wash down from the Ghats the greatest amount of *detritus.* Off the Sind coast in spite of the vast quantities of mud which must be carried down by the river Indus, there is a greater extent of hard ground, a relatively large proportion of the soundings showing sand or mud with sand.

" It follows from the above that most of our trawling was done over a bottom of mud and the great majority of the fish we caught were typical of—or at least tolerant to—a muddy bottom environment.

" On the harder grounds which occur in isolated patches among the mud there appears to be a definite lack of fish—at least so far as the marketable species are concerned. A somewhat surprising dearth of fish life was also found wherever we left comparatively shallow water. Only a very small proportion of the 60,000 square sea-miles lying between the coast and the 100 fathom line appears to carry an appreciable stock of trawlable fish. The area to be regarded as suitable for practical trawling must in fact be limited to within the 40 fathom line. Judging from our results it would rarely be worth while working the trawl in the neighbourhood of Bombay in depths greater than 30 fathoms. Our best catches were almost invariably made between 15 to 25 fathoms. In less than 15 fathoms or at least 10 fathoms there is some difficulty in shooting a large commercial otter trawl because of the risk of the net being over-run by the otter boards owing to there being insufficient water for it to trail off and open properly before it reaches the bottom. For practical purposes therefore the area available for trawling off this part of the West Coast may be regarded as limited to the zone bounded on the land side by the 10 fathom line and to seaward by the 30 fathom line. This cuts off a very large proportion of the strip between the coast and the 100 fathom line which,before being tested, appeared,by considerations of depth, to be available for trawling. For example, the area lying between latitude 18° N. and 20° N. which by its proximity to Bombay would doubtless be subject to most fishing in the event of commercial trawling being carried on from the port, becomes reduced by these limitations to an area of approximately 5,000 square sea-miles. The greater part of the '*William Carrick's*' work was done in this area. Its nearest part lies within one hour's steam from the Harbour, within 20 miles of which some of our biggest hauls were made. Its furtherest northern limit is about 110 miles from Bombay Light Vessel and its furtherest southern limit lies about 55 miles from the same point. It is an area of almost uniformly muddy bottom with the exception of Direction Bank (about 30 to 35 miles roughly S.W. from Kundari or Kenri Island) where one finds sand with shells and coralline masses which make it a dubious locality for trawling. Moreover, on the occasion when we tried we found its fish fauna to be of very little commercial worth."

THE WORK AT SEA.

WORKING METHOD.

Again Mr. Hefford realises the necessity of explaining to his readers how a thing is done. He writes:—

"Passing reference has already been made to the general manner of working of the trawl gear. It will be understood that the net is working (that is, sweeping up any fish which may come within its mouth) while it is being towed. It may further be added that according to the usual present day practice the towing of the trawl calls for the exertion of the trawler's full steaming power. In the case of the '*William Carrick*' the same amount of steam (or coal consumption) which when normally under way would give her her full speed of 9 or 10 sea-miles an hour was required to tow the trawl over the sea bottom at a speed of 2 to 3 sea-miles per hour. Thus the stoke-hold watches were kept working at equal pressure whether we were trawling or steaming. Similarly it was necessary that there should always be a navigating officer—either the mate or the boat-swain who worked alternate watches in this capacity—on the bridge, with a sukani at the wheel and a look-out at the forecastle head.

" When the trawl is hauled the whole of the deck crew are mustered, the skipper handling the ship and directing operations from the bridge, and each officer and man has his station and his job.

"When the cod-end has been heaved in and the catch of fish shot out on deck, the net, if uninjured, is lowered away again for the next haul. Frequently there are rents and holes in the net of greater or less extent which must first be repaired. This work was done by skipper, mate and bo'sun, as to join up a trawl properly calls for some skill and considerable experience; but some of the lascar crew, who were mostly of the fishing community of Ratnagiri, after a time were able to lend a hand with the simpler mends. There was normally an interval of about half an hour from the time when the heaving of the gear was commenced and the time when the net was completely 'shot' (to use the trawler-man's term) for the next tow. On the fishing grounds a uniform daily system was followed by which three hauls of 3½ hours each were made during daylight and two hauls of 5½ hours' duration during the night. Thus, except when damage to the net occupied some considerable time in mending, the trawl was fishing for 21½ hours out of the 24.

"As soon as the trawl is down again the catch of fish from the previous haul receives attention. The different kinds are sorted out and cleaned. The large fish such as Goal, Ravas, Tambusa, Karel, Wam, Shingala and Rays are gutted, and all are given a thorough washing with sea-water from a hose. The swim-bladders ("poks" or "maws") of Goal, Rawas, Wam and Shingala are removed and cleaned and subsequently hung up to dry since these have their own market value as a source of isinglass. The fish are then put in baskets and weighed before being lowered into the fish room where they are packed in the "pounds".

"The fish-hold is maintained at a low temperature by means of the refrigerating plant. In practice it was found necessary to run the refrigerator only for an hour or so every morning and evening in order to keep the fish room at a temperature a little above freezing point, which was the most suitable for our purposes. A temperature so low as actually to freeze the fish hard is *not* desirable. Apart from the fact that the temperature of the '*William Carrick's*' fish room was artificially lowered, the treatment of the fish in storing was practically exactly the same as that followed on British steam trawlers. One of two tons of ice was carried and broken fragments of this ice were scattered over the layers of fish as they were packed in the pound in the fish-hold. The moisture from this slowly melting ice serves to keep the fish moist and fresh-looking.

"The Marine Biologist's observations and records are made while the fish is on deck. The only operations calling for present notice are the identification to the species and the weighing of the different kinds. The weighing was done on a spring balance. When the motion of the ship was lively, as it frequently was, it was impossible to get a reading that was accurate to a few pounds. However both in the readings of the scale and also in the allowance that was made for the weight of the basket, the principle was adopted of recording a figure that would be well *below* rather than a little above the real weight. In calm weather a closer approximation to accuracy was possible; but in all cases the figures referring to the weights of each haul of fish may be regarded as minimal. The weights of all except the smallest fish were taken after the fish had been cleaned and the entrails removed."

CHIEF KINDS OF FISH CAUGHT.

One point struck us at once on reading this part of the report. How was it no Bahmin had been taken in the trawl? Surely Mr. Hefford would have made some mention of this fine fish. Here the Scientist chuckled loudly: "See the advantage of a scientific name. You lazy people will not trouble to learn the scientific name nor will you even trouble to learn all the common or vernacular names. You know the fish as "Bahmin." You cannot recognise it under the vernacular name given by Mr. Hefford, " Ravas," even though he does call it the " Indian Salmon " ; but if you had troubled to learn your scientific names you would have seen from the mere mention of the genus *Polynemus* that any how one of the three species of fish called in the vernacular " Ravas " was your Bahmin. So too would you have been saved trouble if you came from Karachi where the " Ravas " is called " Seer." In Bombay the " Seer " fish or Surmai belongs to the genus *Cybium*." In regard to this question of names Mr. Hefford writes :—

"It is necessary to introduce some scientific names, for without them there can be no precision as to which species are concerned. In the market or fishermen's vernacular one name is frequently applied to fishes which are of different species from the ichthyologist's point of view. The larger classes which the scientist calls *genera*, the members of which possess in common more—or more conspicuous —similarities than differences, are usually patent to the eye of the fisherman and it is thus found that vernacular names usually coincide with generic names while specific differences among the members of a genus are often ignored."

Mr. Hefford describes the fish in order of their value and abundance as indicated by the total sum realised by the sales.

In the next number of the Journal we shall continue with a description of the principal edible fish—of which we hope to issue illustrations, and we shall conclude with Mr. Hefford's remarks on the possibility of achieving commercial success with small boats and deep sea seining. We shall also make a reference to the needs of a market on shore, and we shall be pleased to include (if possible) any comments and suggestions, members of the Society may have to make on the portion of the report now published.

(*To be continued.*)

SCENERY IN GULMARG.

BIRD-LIFE IN GULMARG.

BY

B. B. OSMASTON, I.F.S.

(*With a plate.*)

Gulmarg is an extensive, more or less undulating, grassy meadow, situated on the North-East slope of the Pir Panjal mountain range in Kashmir, at an elevation of about 8,600 feet above the sea, and about 3,500 feet above the valley of Kashmir.

It is well watered by snow-fed streams coming down from the slopes of Apharwat (height nearly 14,000 feet) and is surrounded on all sides by a magnificent forest of silver firs, with which are mixed, on suitable aspects, the blue pine, the spruce, the yew and a few broad-leafed trees such as maples and cherry.

The silver fir forest extends up the slopes above Gulmarg to an altitude of about 11,000 feet, where it is succeeded by bare slopes with patches of dwarf juniper, birch and *Rhododendron campanulatum* and still higher by dwarf rhododendrons, and lonicera and a profusion of alpine flowers.

The undergrowth in the fir forest, where there is any, consists, in the opener portions, of viburnum and in the denser cover, of skimmia.

Wild roses are also abundant in the more sunny blanks.

The forest, except in the immediate vicinity of the station, is in a virgin condition, and huge tree trunks in various stages of decay, litter the ground.

The summer rainfall is fairly heavy, as is also the fall of snow in winter, with the result that the climate is moist and temperate.

Birds are numerous in the vicinity of the station, whereas in the dense fir forests bird-life is, as is usual in such localities, somewhat scarce.

The crow family (including the tits), the warblers, the flycatchers,the *Turdinœ* and the finches are all well represented. On the other hand of the huge Indian family, the *Crateropodidœ* (excluding the *Brachypteryginœ* which are really *Turdinœ*) there are only two representatives. There are no bulbuls, kingcrows, shrikes, starlings, mynahs, larks, king fishers, nightjars, swallows, martins, swifts, sunbirds, bee-eaters, pigeons or paroquets, and cuckoos are scarce.

During a residence of 4 months, June to September, spent in Gulmarg the writer observed 76 different kinds of birds, notes on which are given below.

The numbers refer to the Fauna of British India*.

4. *Corvus macrorhynchus.*—The Jungle Crow.

This is the only crow (excluding the Jackdaw) which is found in Gulmarg, where it is all too common. They destroy many small nests and devour eggs and nestlings. I observed one in the act of pilfering the nest of a willow warbler *Phylloscopus tytleri*, in a fir tree.

This crow does not, I think, breed in Gulmarg, but they come up from below after breeding as soon as the snow melts on the marg, *i.e.*, in May. They are found up as high as 12,000 feet.

9. *Corvus monedula.*—The Jackdaw.

Jackdaws did not appear in Gulmarg until the 7th August when I saw a flock of about 20 on the marg. Since this date they-were present in large numbers and were as numerous as the crows.

They ascend the hills to about 10,500 feet.

29. *Graculus eremita.*—The Red-billed Chough.

These birds are found on Apharwat and the neighbouring rocky hills and crags, above 12,000 feet in the summer months. They are, however, not very numerous.

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* First edition.

28. *Nucifraga multipunctata.*—The Larger Spotted Nutcracker.

This is a fairly common bird in and around Gulmarg, more especially in the Blue pine forest. They feed largely on the seeds of the Blue pine.

They are early breeders, and when I arrived in Gulmarg, in the end of May the young were already strong on the wing.

34. *Parus monticola.*—The Green-backed Tit.

Noticed this bird on two or three occasions only, in August and September. They are not common.

38. *Ægithaliscus niveigularis.*—The White-throated Tit.

This tit is rare in the vicinity of Gulmarg. I saw a single individual at about 9,500 ft. in the fir forest below Khilanmarg. It was feeding along with other tits, (*Lophophanes*) and *Phylloscopi.* This was on 20th September.

44. *Lophophanes melanolophus.*—The Crested Black Tit.

This is the commonest tit in Gulmarg, hunting the fir trees in company with Willow-wrens, for insects.

I found several nests in holes in trees, and in Bungalows during June. Some had eggs, others young.

47. *Lophophanes rufinuchalis.*—The Simla Black Tit.

This tit is also common in the fir forest but less so than the preceding, from which it can be readily recognised—

(1) by its larger size,

(2) by its general darker appearance,

(3) by the absence of the wing bars.

One day in August I surprised one which had been bathing rather too freely and caught it, as it was too wet to fly !

91. *Trochalopterum simile.*—The Western Variegated Laughing-Thrush.

This species is not found in the immediate vicinity of Gulmarg but occurs higher up on the slopes of Apharwat from about 10,000 to 11,000 feet in the birch and rhododendron forest, where it is not rare.

99. *Trochalopterum lineatum.*—The Himalayan Streaked Laughing-Thrush.

Found fairly commonly in the fir forest, where there is much undergrowth, and in open patches of *Indigofera* and *Polygonum, e.g.,* below the Residency. Nests were found in June and July.

187. *Myiophoneus temminki.*—The Himalayan Whistling-Thrush.

Common in most of the ravines and along mountain torrents. Occasionally seen and heard on the marg.

A pair built a nest under the eaves of one of the huts in the station and successfully reared 3 young in August.

191. *Larvivora brunnea.*—The Indian Blue Chat.

This Robin is fairly common in the opener portions of the silver fir forest around Gulmarg. It is a shy, retiring bird, more often heard than seen.

It has rather a sweet, short song commencing with the same note repeated slowly generally four or five times, at first softly, but growing louder with each repetition, followed by a short turn of a few notes uttered more rapidly.

The alarm call, chiefly heard when the young have left the nest, is a high note, Tsee—also a gutteral " Tuck ".

Several nests were found, the first on the 17th June. All were placed in the angle between the roots or buttresses of big fir trees, on the ground. They were constructed exteriorly of lichens and dead leaves and were lined with a little wool hair or feathers.

The eggs, four in number, are uniform pale blue. The young birds are spotted and mottled just like young robins and evidently have been wrongly placed in the Fauna. They are typical Turdidæ.

199. *Hodgsonius phœnicuroides.*—Hodgson's Shortwing.

This is a common bird in and above Gulmarg up to about 11,000 feet, frequenting the low, dense scrub, consisting of viburnum, skimmia and juniper.

They are just as shy and retiring as *Larvivora.* Occasionally, however, the cock bird will mount to the topmost sprig of a thick bush, and raise and spread his tail, displaying the outer red feathers of the tail which are normally concealed. At the least alarm, he will dive into thick cover again. The song consists of three notes only, rather a melancholy cadence, in which the middle note is higher than the other two, and the last is about a semi-tone lower than the first. It is rather crepuscular in its habits and often calls on moonlight nights.

The nest is a rather deep cup, loosely constructed of dry weed stalks, grass and small sticks, neatly lined with dry blue-pine needles or dry grass with lastly a little hair or a few feathers, and is placed low down in a thick bush. The eggs generally 3, sometimes only 2 and more rarely 4, are very deep blue.

The young are spotted as in the Turdidæ to which family this species undoubtedly belongs.

320. *Sitta kashmiriensis.*—Brook's Nuthatch.

Resembles the English Nuthatch. Is not uncommon in fir forest. Observed in August and September.

323. *Sitta leucopsis.*—The White-cheeked Nuthatch.

This species is commoner than the last, and keeps usually to the higher trees. It has rather a harsh note, frequently repeated.

Two nests were found on the 11th and 23rd June respectively. The first was in a small hole in a big silver fir, the second in a hole about 2″ × 3″ in a big yew. Both nest holes were about 18 feet from the ground, and both contained fully fledged young. In neither case had any attempt been made to reduce the size of the entrance hole with mud or any other substance. Nests were at an elevation of about 9,000 feet.

341. *Certhia himalayana.*—The Himalayana Tree-Creeper.

Common in and around Gulmarg up to the limit of forest. Hunts up and down the trunks of firs and other trees, for insects, and is not shy.

342. *Certhia hodgsoni.*—Hodgson's Tree-Creeper.

Similar in appearance and habits to the last but is not so common. May be distinguished from the last, at close quarters, by the absence of cross bars on the tail.

352. *Anorthura neglecta.*—The Kashmir Wren.

Common in Gulmarg, and also in the surrounding silver fir forest. It is also found on the rocky slopes above the limits of forest up to at least 12,500 feet.

It is similar in appearance and habits to the English wren, and its loud cheery song is also very similar to that of its western cousin. Several nests were found early in June, mostly under the overhanging roots of fallen trees, two in cracks in standing trees and one in the roof of a Gujars' hut. Two nests contained 5 fresh eggs, and one four hard set eggs.

Nests were invariably constructed exteriorly of lichens, and were lined with moss hair and feathers, and resembled nests of the English wren. The eggs, too, were very similar to those of the English wren.

358. *Regulus cristatus.*—The Gold Crest.

One bird was seen on August 30 and several more on September 8, feeding with tits and *Phylloscopi* on branches of silver fir in Gulmarg. They were exceedingly tame. They probably breed in Gulmarg.

405. *Phylloscopus affinis.*—Tickell's Willow Warbler.

This little willow wren is not found in Gulmarg itself, but is common on the slopes of Apharwat above, from Khilanmarg at 10,000 feet, up to the limits of the dwarf rhododendron, *i.e.*, about 12,000 feet. They may be distinguished from the other willow warblers found in Gulmarg by their deeper yellow colouration below as well as by their characteristic notes. The nest is domed, made of dry grass and copiously lined with feathers, and is placed in low scrub, *Lonicera*, &c., about 6 inches from the ground. The eggs, four in number, are sparingly spotted with pale rust colour, or sometimes unspotted white.

415. *Phylloscopus proregulus.*—Pallas' Willow Warbler.

Not uncommon in the fir forest in and around Gulmarg.

A bird was observed building her small domed nest, of lichens lined with feathers, on the branch of a fir, 12 feet from the ground on July 7. A few days later it was destroyed by a Jungle Crow. This willow warbler is most easily distinguished by its small size and pale yellow rump.

418. *Phylloscopus humii.*—Hume's Willow Warbler.

This willow warbler is exceedingly common in and around Gulmarg, especially in sunny openings in the fir forest. Nidification commences in the first week in June. The nests, of which I found many, were domed, and on the ground, on banks, and generally fairly well concealed. They were built of fine dry grass stems and lined with finer grass flower stems, or dry pine needles and finally with a little hair.

Four eggs, rarely five, are laid—which are well spotted with reddish brown, very similar to some tits eggs.

412. *Phylloscopus tytleri.*—Tytler's Willow Warbler.

This rather plain-coloured willow warbler is common in Gulmarg up to the limit of tree forest.

They frequent silver fir forest, chiefly the sunny openings or margins of the forest, and spend a good deal of their time hunting for food in the low undergrowth, viburnum scrub, etc.

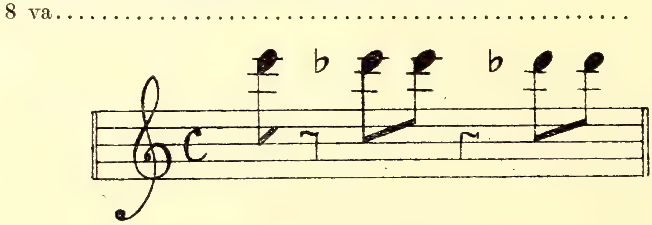
I was led to believe that these birds nested in such low scrub but eventually found several nests in fir trees, 20 feet or more from the ground. Unfortunately they all contained young. This was in the end of June so eggs might be sought for early in the same month.

The nests were very small, domed and similar in structure to those of *P. proregulus*. The note of the bird, repeated constantly in the spring at intervals of $\frac{1}{4}$ minute or less, may be represented by the words "Lets kiss him" or sometimes "Superstition."

424. *Acanthopneuste magnirostris.*—The Large-billed Willow Warbler.

This large willow warbler, which by the way has not a particularly large bill for its size, is found in all the ravines containing flowing water in the vicinity of Gulmarg, up to 9,500′ elevation and down to at least 6,500′.

The presence of the bird may be at once known from its characteristic and striking call of 5 notes, which it repeats at intervals, generally from some tree. The call may be represented musically as below:—



It has also an alarm call of two clear notes, the second the higher, the musical interval between the two being one-fifth.

This species, unlike all other willow warblers of my acquaintance, is almost invariably found in the vicinity of running water and might well have been styled the water wren.

The nest is difficult to find being well concealed under a fallen log or in the overhanging roots of a tree. Nests found by me were all in close proximity to the stream and two were actually over the water.

The nesting season is throughout June and July, fresh eggs, as well as freshly hatched young having been found on July 8 and fresh eggs again on July 23.

The nests are loosely composed of dry grass stems, moss, dead leaves, fern, lichen, etc., and are lined with fine dry grass flower stems. Eggs, three in number, are pure white and very fragile.

428. *Acanthopneuste occipitalis.*—The Large Crowned Willow Warbler.

This is the commonest willow warbler in the fir forests of Gulmarg. Its monotonous call is to be heard all day and every day in June and July. It consists of a shrill note repeated rapidly about 7 times which may be syllablized as follows :—Tee—Tsee-Tsee-Tsee-Tsee-Tsee-Tsee. The alarm call, heard whenever one approaches within even 30 or 40 yards of the nest, is a double note resembling "chick-wee."

Nests are difficult to find as they are well concealed and the birds do not readily give them away.

As nesting sites, holes at the root of trees, holes in the ground or holes in trees are utilized. Seven nests were found by me early in June, one in a hole in the earth on gently sloping ground, another in a hole in the earth in the up-turned roots of a tree 6 feet from the ground, a third in the ground under a fallen log, a fourth in a hole in a small cherry tree 6 feet from the ground, two others in holes in big yew trees 15 and 20 feet from the ground respectively, and lastly one between the double boarding of the wall of the hut in which I was living, 2 feet from the ground.

The nests were all constructed of moss. They consist of a rough saucer-shaped pad, with usually an attempt at a dome. There is sometimes a little wool for lining. Eggs, four in number, are pure white and fragile.

This species is found up to the upper forest limit. Birds ceased calling early in August, and were not in evidence at all in September.

495. *Pericrocotus brevirostris.*—The Short-billed Minivet.

Not uncommon in Gulmarg in June-July. They probably breed a little lower down.

578. *Oriolus kundoo.*—The Indian Oriole.

Saw one, and heard it calling at Gulmarg on June 9. It was only a stray bird and this species does not ordinarily ascend to this elevation.

558. *Hemichelidon sibirica.*—The Sooty Flycatcher.

This is the commonest flycatcher in Gulmarg. It is found in the station and extends up to the limits of tree growth, *i.e.*, about 11,000 feet. They were fairly numerous when I arrived on the 30th May and they commenced building early in June.

They hawk flies from a fixed perch, often near the tops of the highest trees but also not infrequently close to the ground.

The nests are built usually on the leafy portion of fir branches, at all heights from the ground. The lowest nest I found was 7 feet from the ground, but they are usually 20 feet or more.

The nest is a very neat, compact cup composed externally of grey lichens and lined, first with a little fine dry grass and hair and lastly a few feathers.

The eggs are four or three in number, very pale greyish green with a tinge of pale rufous suffused over the larger end of the egg.

567. *Cyornis leucomelanurus.*—The Slaty-blue Flycatcher.

This pretty little pied flycatcher is almost, if not quite, as common as the last. They are found throughout the fir forest up to about 10,000 feet. They keep usually low down in the bushes and undergrowth.

The male has a short little song not often heard. The alarm call when danger is threatened, is a double call resembling "Ee-tick."

Nests are conspicuous and easily found being placed in crevices in standing trees usually from 3 to 6 feet from the ground or sometimes among the roots of fallen trees. One nest found was against the trunk of a tree 20 feet from the ground but this was exceptional. Nests are constructed of fine moss consolidated with cobwebs, lined with still finer moss and a little hair.

Four is the full complement of eggs but sometimes only 3 are laid. They are a delicate pale buff-marked at the large end with a pale rufous cap or ring.

568. *Cyornis superciliaris.*—The White-browed Blue Flycatcher.

This little flycatcher is much less common than the last species. It occurs, however, sparingly throughout the fir forest.

A single nest was found on June 28, containing 4 nearly fresh eggs.

A deserted nest of the Kashmir wren, placed in a crevice of a cherry tree 7 feet from the ground had been appropriated. The nest had been re-lined with a little fine dry grass and hair. The eggs are clouded all over with pale rufous, the ground colour, where visible being very pale green.

589. *Alseonax ruficaudus.*—The Rufous-tailed Flycatcher.

This flycatcher is fairly common throughout the fir forest from about 8,000 to 10,000 feet. It is not much in evidence in June. During this month the song of the male is constantly heard uttered generally from a considerable height in a fir tree. It consists of 3 or 4 rather loud clear notes which are varied from time to time in several ways. The song reminds one somewhat of that of *Petrophila cinclorhyncha.*

The birds are solitary. They have not the habits of a typical flycatcher but resemble arboreal chats. They flick their wings and bob the body forward just like a chat.

In July the alarm call began to be heard on all sides. It consists of a single note "see" repeated several times followed by a vibrating note.

A single nest only was found built on a short thickish fir bough a foot from the main trunk and 30 feet from the ground. This was on July 5. It contained 3 half fledged young.

This species, unlike most flycatchers, is exceedingly wary in approaching its nest, which, being situated high up in a tree, is consequently very difficult to locate.

The nest was a neat cup composed of fine moss and lichen coated externally with cobweb and rather scantly lined with hair and a few feathers.

615. *Oreicola ferrea.*—The Grey Bush-Chat.

Not uncommon in Gulmarg station area where they breed in June and July. Nests well concealed on the ground among herbacious growth.

638. *Chimarrhornis leucocephalus.*—The White-capped Water Robin.

This beautiful little bird is found on all the larger streams both above and below Gulmarg.

639. *Ruticilla frontalis.*—The Blue-fronted Redstart.

Occurs, but is not very common, on the slopes of Apharwat above Gulmarg at about 11,000 to 12,000 feet. It doubtless breeds in this area, among the rocks.

646. *Rhyacornis fuliginosus.*—The Plumbeous Water-robin.

Common on the streams near and below Gulmarg where it also breeds.

651. *Calliope pectoralis.*—The Himalayan Ruby-throat.

This species is found sparingly on the rocky slopes of Apharwat above Gulmarg at from 11,000 to 13,000 feet.

No nest was found but young birds were observed early in September.

654. *Ianthia rufilala.*—The Red-flanked Bush-robin.

This species is common in forest from Gulmarg up to the limits of tree-growth. They are early breeders and nests can be found in May and June while snow is still lying about.

The song or call, which is constantly heard in May and June, consists of three notes, the first and last being the same note, and the middle one a little lower in the scale.

Nests are built on the ground and are often lined with musk deer hair.

The eggs, four in number, are white or exceedingly pale green sparingly speckled with rufous.

666. *Merula maxima.*—The Central Asian Blackbird.

This bird is not found in Gulmarg but occurs on the slopes of Apharwat above the forest level among the juniper and dwarf rhododendron scrub and rocks at from 11,000 to 13,000 feet.

The alarm call resembles that of the English Blackbird.

On June 13, a pair of birds were seen which evidently had young somewhere in the vicinity.

On June 23, young birds were seen with their parents. They must have left the nest at least a fortnight.

Nests are probably built in the dense juniper scrub which covers the rocky slopes on south aspects. Eggs would be found towards the end of May.

673. *Merula castanea.*—The Grey-headed Ouzel.

These birds are not uncommon in the fir forest round Gulmarg where they doubtless breed.

691. *Petrophila cinclorhyncha.*—The Blue-headed Rock Thrush.

Not uncommon on the open sunny slopes below the Residency, Gulmarg. Fully fledged young were observed with their parents on June 30.

694. *Turdus viscivorus.*—The Mistle Thrush.

Fairly common in the opener portions of the fir forest. The song is often heard in June from the summits of tall fir trees.

A nest was found with 3 fresh eggs on a fir branch, about 6 feet from the ground on 16th June, but this was probably a second nest.

The birds begin to congregate in small flocks after the middle of August.

719. *Tharrhaleus jerdoni.*—Jerdon's Accentor.

Common in the viburnum, skimmia and juniper scrub, both in open forest and above the limit of trees from Gulmarg up to about 11,500 feet.

Has a rather pretty little song, but with a few harsh notes interspersed.

Nidification commences early in June. Nests are usually built in the dense scrub about 1 to 2 feet from the ground but one nest was found on a fir bough 7 feet from the ground.

Nests are built of thin sticks, moss and lichen, lined with fine dry grass, a little hair and feathers. Four, or sometimes only three, eggs are laid, of a uniform blue.

709. *Cinclus asiaticus.*—The Brown Dipper.

Common on all big streams in the vicinity of Gulmarg from 10,000 feet downwards.

741. *Pycnoramphus icterioides.*—The Black and Yellow Grosbeak.

Common in the fir forest in and around Gulmarg up to about 10,000 feet. They doubtless breed in these forests.

753. *Pyrrhospiza punicea.*—The Red-breasted Rose-finch.

Saw several of these birds near the summit of Shin Mahinyu (15,000′) on Aug. 10. This mountain is situated only about 10 miles south-east of Gulmarg, and it is probable that this species will also be found on Apharwat though I did not observe it there.

767. *Carduelis caniceps.*—The Himalayan Goldfinch.

Goldfinches begin coming up to Gulmarg early in June, probably after breeding down below. I observed a pair, with young on June 5. Later on in the season many more birds arrived and by September they were quite numerous, feeding on the seed of the large white thistles. I am inclined to think they breed a second time in Gulmarg but I failed to find a nest.

780. *Passer cinnamomeus.*—The Cinnamon Tree-Sparrow.

This is the common and only sparrow found in Gulmarg. They are as tame and confidential as the ordinary house sparrow. The majority build their nests in the roofs of the huts and out-houses but I found two nests in the forest, in old nest-holes of the Himalayan Pied Woodpecker.

768. *Callacanthis burtoni.*—The Red-browed Finch.

This fine finch is not uncommon in the fir forest from Gulmarg up to about 10,000 feet elevation. They occur in pairs and small parties and feed chiefly on the ground, especially in the early spring, where the snow has just disappeared.

They are not at all shy and allow one to approach fairly close.

They are early breeders and I saw the young fully fledged and strong on the wing early in June.

The call note is a loud clear whistle not unlike, but a little higher in tone than the ordinary call of the Bulfinch.

772. *Hypacanthis spinoides.*—The Himalayan Greenfinch.

Common in and around Gulmarg where they breed in the fir and pine trees in July and August.

787. *Fringilauda sordida*—Stoliczka's Mountain Finch.

Very common on the upper rocky slopes of Apharwat from about 12,000 feet to 13,500 where they breed.

Nests contained young in July and August.

794. *Emberiza stracheyi.*—The Eastern Meadow Bunting.

This is a very common bird both in Gulmarg and below and above it up to at least 11,000 feet. They frequent open rocky slopes with stunted herbacious vegetation.

The male has rather a pretty short song not unlike that of the Goldfinch.

Breeding commences in May at the lower elevations of its range and continues throughout June, July and August.

Nests are built on or close to the ground and are usually well concealed.

Three or four eggs are laid which are of the typical Bunting style, being streaked with pale purple.

805. *Chelidon kashmiriensis.*—The Kashmir Martin.

I did not observe this bird in the vicinity of Gulmarg but I saw several pairs hawking insects at 13,000 feet above Pandan Pathar (Ferozpur nala) about 7 miles South of Gulmarg. They probably breed under the cliffs in this neighbourhood.

830. *Motacilla hodgsoni.*—Hodgson's Pied Wagtail.

Several pairs frequented the streams in Gulmarg in June and July and one pair had a nest with young under the eaves of the church on June 25.

The young birds are of a uniform pale grey above.

832. *Motacilla melanope.*—The Grey Wagtail.

Common in Gulmarg, along streams and up the valleys above up to about 12,000 feet or higher.

A nest in the stone work of a bridge in Gulmarg contained 4 young on June 25.

On Aug. 10, saw a pair with fully fledged young feeding by a lake above Tosha Maidan at 13,000 feet.

850. *Anthus rosaceus.*—Hodgson's Pipit.

Not found in Gulmarg itself, but occurs sparingly on Apharwat, at from 11,000 to 13,000 feet where it breeds.

Found this species very common above Tosha Maidan, 10 or 12 miles South of Gulmarg.

961. *Dedrocopus himalayensis.*—The Western Himalayan Pied Woodpecker.

This is the only woodpecker found in the Gulmarg area, where it is exceedingly common in the fir forest.

Their nesting holes, in dead fir trees, are conspicuous everywhere.

1066. *Upupa epops.*—The European Hoopoe.

A few were seen feeding in compounds in Gulmarg between July 25 and August 15.

1024. *Coracias garrula.*—The European Roller.

Shot a solitary bird at 10,500 feet on Khilanmarg, above Gulmarg. This was the only bird seen and was evidently only a straggler. This species is common in the valley below.

1069. *Cypselus apus.*—The Swift.

Saw several birds which appeared to belong to this species flying around some precipitous rocky ground near Tosha maidan at 11,500 feet. This was on August 9.

1104. *Cuculus canorus.*—The Cuckoo.

Not uncommonly heard in Gulmarg during June.

1105. *Cuculus saturatus.*—The Himalayan Cuckoo.

Heard calling on June 23, on the Eastern slope below Gulmarg.

1106. *Cuculus poliocephalus.*—The Small Cuckoo.

Heard the characteristic call of this cuckoo on one occasion only, July 10, at about 11,000 feet elevation above Gulmarg.

1141. *Palæornis schisticeps.*—The Slaty-headed Paroquet.

Noted this bird flighting over Gulmarg once or twice in the early morning in August and September.

1159. *Syrnium biddulphi.*—Scully's Wood Owl.

Not uncommon in the fir forest in and above Gulmarg.

The call, heard an hour or so after sunset, is a loud Hoo followed after an interval of about four seconds by an almost continuous rolling hoot—Hoo-Hoo-Hoo-Hoo.

1186. *Glauciduim brodiei.*—The Pigmy Collared Owlet.

This owlet is very rare in Gulmarg but is found on the lower eastern slopes of the hill, where I heard its call on Aug. 26.

1193. *Gyps himalayensis.*—The Himalayan Griffon.

Not uncommon on the hills above Gulmarg, especially at from 10,000 to 12,000 feet.

1199. *Gypaëtus barbatus.*—The Lammergeyer.

Commonly seen beating to and fro over the bare hill sides above Gulmarg at from 10,000 to 14,000 feet.

1230. *Milvus melanotis.*—The Larger Indian Kite.

Common in Gulmarg during July, August and September. They ascend the hills to a considerable elevation and I saw one at 12,000 feet in July.

They do not breed in Gulmarg.

1239. *Buteo ferox.*—The Long-legged Buzzard.

Fairly common above Gulmarg near the upper limit of fir forest and up to about 11,000 feet.

They have a wild mewing cry.

They feed largely on voles and mouse-hares. A nest was observed near the top of a big fir tree at about 10,000 feet on June 27. It probably contained young as the parent birds were very noisy and much perturbed.

1248. *Accipiter virgatus.*—The Besra Sparrow Hawk.

Not common in Gulmarg. Shot a young bird of the year near Gulmarg on August 16. It was calling loudly, the shrill vibrating call of this species.

1260. *Falco subbuteo.*—The Hobby.

A pair took up their quarters near my hut in Gulmarg in August.

1265. *Tinnunculus alaudarius.*—The Kestrel.

Common in the station of Gulmarg and on the hills above up to at least 12,000 feet. At least two pairs nested in tall trees in the station, in June.

1305. *Turtur ferrago.*—The Indian Turtle-Dove.

Common in Gulmarg and in the surrounding forest, where they breed in June and July.

1342. *Lophophorus refulgens.*—The Monal.

Seen on Apharwat in June at about 11,500 ft. They are however rare on these hills.

1370. *Caccabis chucar.*—The Chukor.

Found sparingly on the bare hills above Gulmarg. Put up a covey of about a dozen half-grown young just above Khilanmarg at about 10,500 ft. on August 25.

1378. *Tetraogallus himalayensis.*—The Himalayan Snow-Cock.

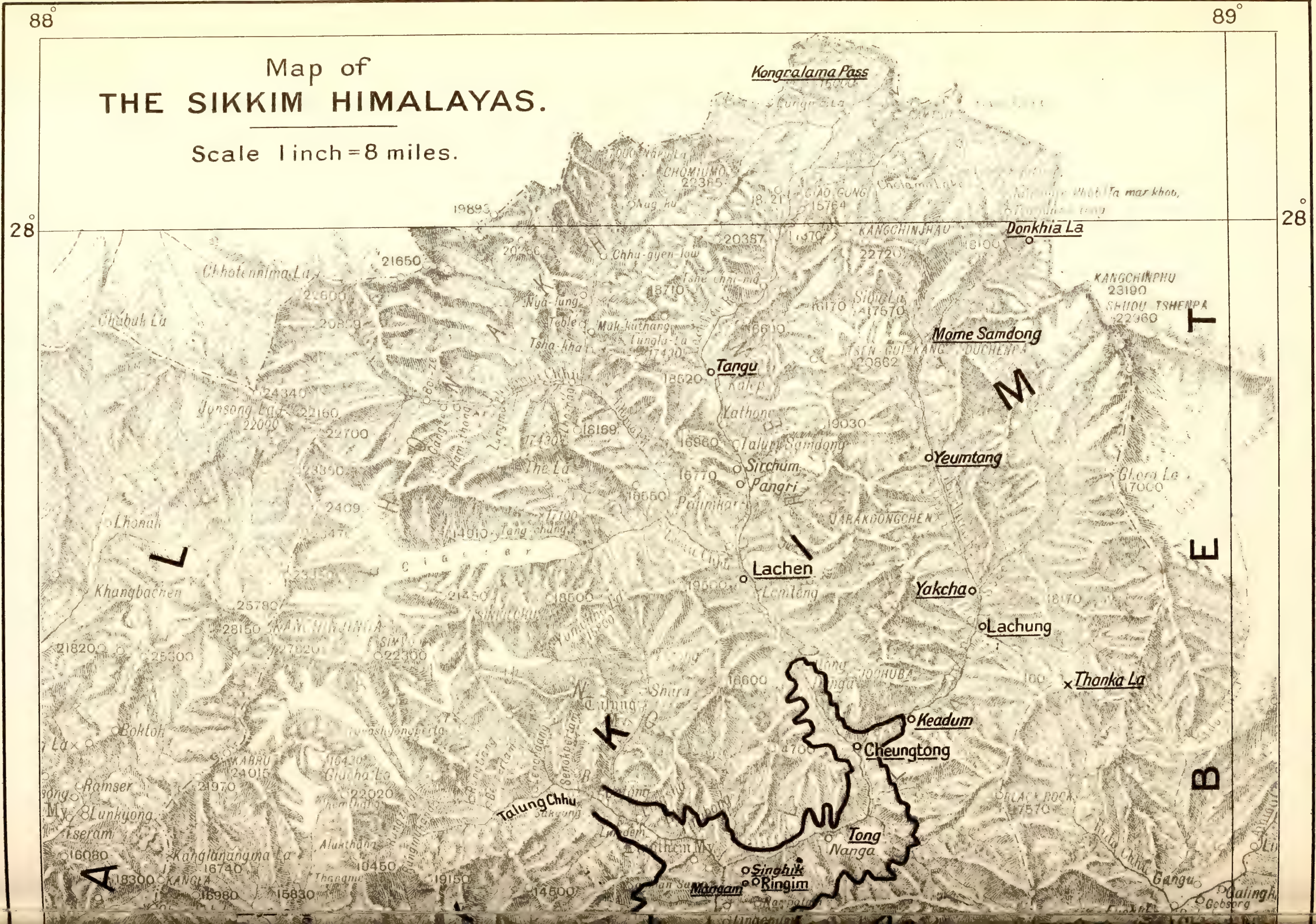
This bird is found, but is not very common, on Apharwat and the neighbouring hills above the level of forest.

I put up four full grown birds at 12,000 feet on the hill above Gulmarg on Aug. 5, and a large covey of about ten on Aug. 9, N.E. of Tosha Maidan at about the same elevation.

The latter were mostly young birds about half grown.

1482. *Scolopax rusticola.*—The Woodcock.

Woodcock were flushed by me on two or three occasions in damp spots in the fir forest near Gulmarg in June and on July 20 a nest with three rather hard set eggs was found among Skimmia undergrowth on a hill side in the fir forest east of Gulmarg at 9,000 feet elevation.



Map of

THE SIKKIM HIMALAYAS.

Scale 1 inch = 8 miles.

88°
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Kongralama Pass
CHOMIUMO
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GIAO GUNG
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20357
KANGCHINJHAU
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Donkhia La
KANGCHINPHU
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SHUDU TSHENPA
22960
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Chhu-gyen-low
21650
Chhotenmima La
Chabuk La
Nya-lung
Mak-kuthang
Tunglu-La
Tsha-kha
Mome Samdong
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Tangu
18620
M
24340
Jonsong La
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22700
18169
Lathong
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Talung Samdong
Sitchum
Pangri
The La
23850
2409
Glom La
17000
JARAKDONGCHEN
Lhonak
Tang chung
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Lachen
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Lamteng
Yakcha
18170
Lachung
Khangbachen
25780
28150
KANCHINJUNGA
21820
25300
22300
Thanka La
16600
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Cheungtong
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Boktoh
Ramser
KABRU
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Glacha La
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21970
Talung Chhu
BLACK ROCK
17570
B
Lunkyong
Iseram
16080
Kanglanangma La
16740
Aluktheng
10450
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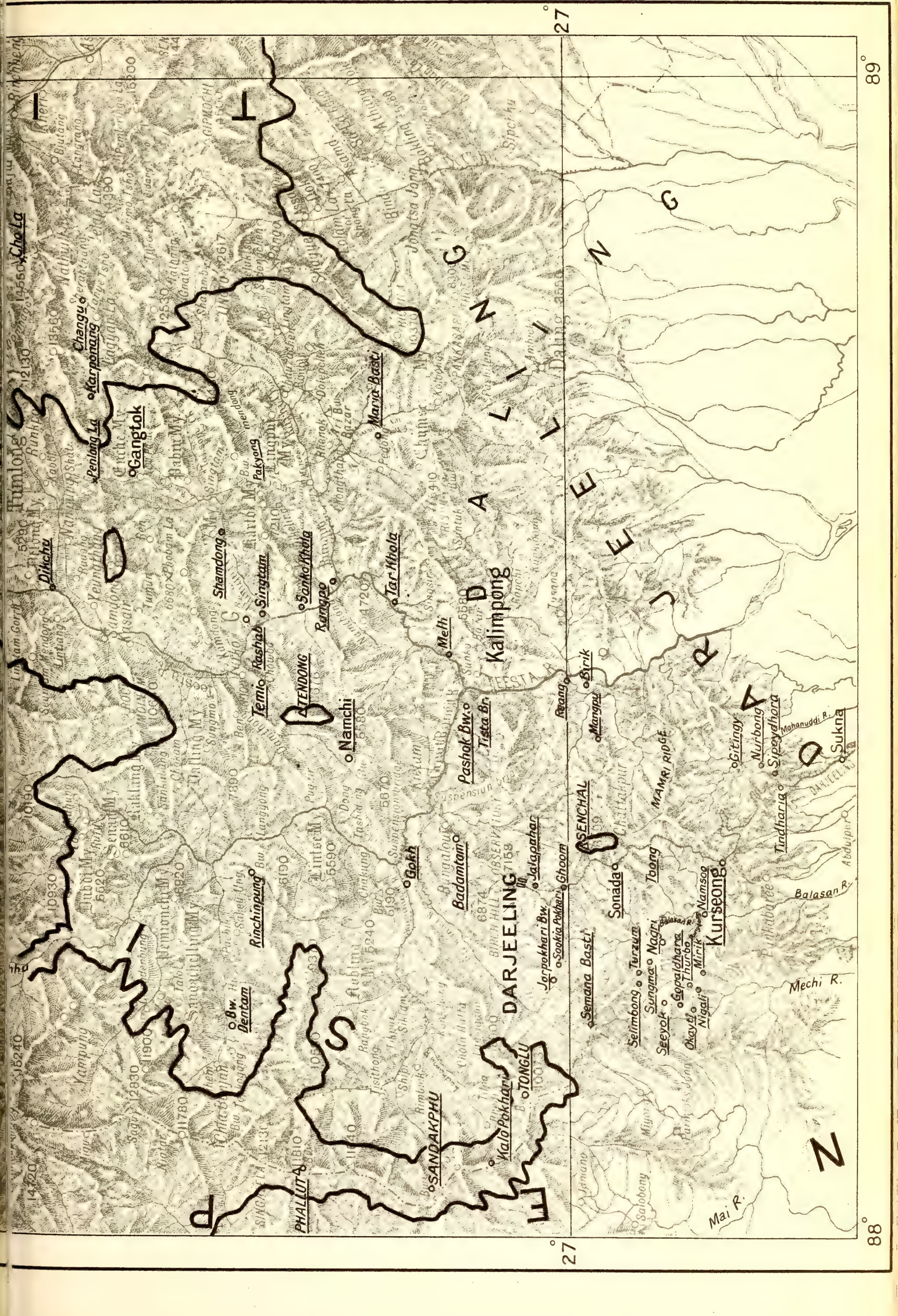
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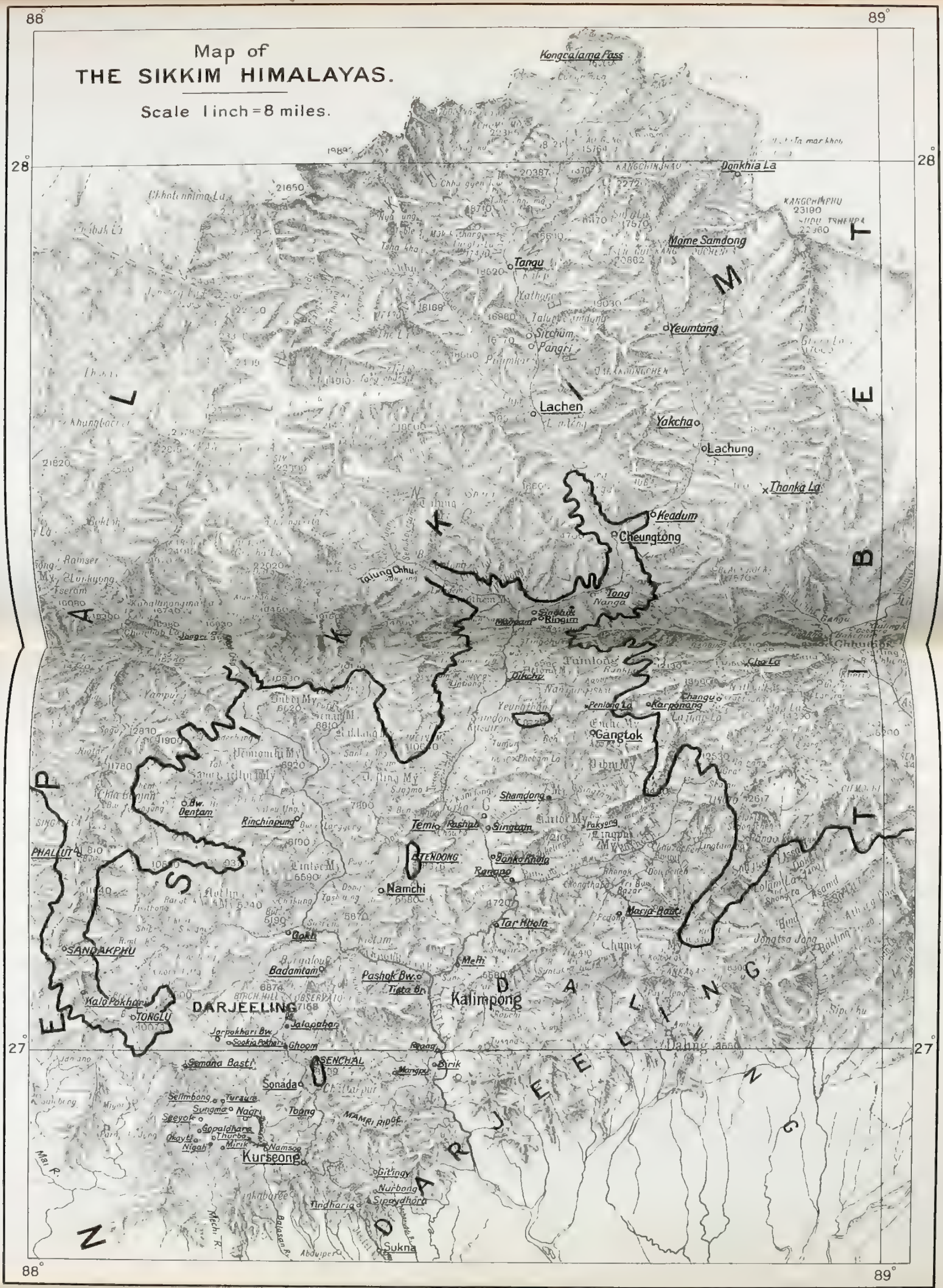
Tumlong
Dikchu
Shamdong
Singtam
Rashab
Temi
Sankokhola
Rangpo
Tar Khola
Maria Basti
Pakyong
Kalimpong
Melli
Namchi
Tendong
Pashok Bw.
Tista Br.
TEESTA R.
Rirek
Reang
Mangpu
SENCHAL
Sonada
Ghoom
Jalapahar
Darjeeling
Badamtam
Gokh
Rinchinpung
Dentam
Bw.
TONGLU
Kalo Pokhari
SANDAKPHU
PHALLUT
Jorpokhari Bw.
Sookia Pokhari
Semana Basti
Selimbong
Turzum
Sungma
Nagri
Seeyok
Gopaldhara
Okayti
Thurbo
Nigali
Mirik
Namsoo
Kurseong
Toong
MAMRI RIDGE
Gitingy
Nurbong
Sipoydhora
Tindharia
Sukna
Mahanuddi R.
Balasan R.
Mechi R.
Mai R.
Suspension Bridge
BIRCH HILL
OBSERVATORY HILL
Pankabari
Dalingo
Jalapahar



Map of THE SIKKIM HIMALAYAS.

Scale 1 inch = 8 miles.

88°
89°
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Kongcalama Pass
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23190
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Tangu
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Lachen
Yakcha
Lachung
Thanka La
Keadum
Cheungtong
Talung Chhu
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Nanga
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Ringim
Dikchu
Tumlong
Cho La
Chhumbi
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Karponang
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Pakyong
Bw. Dentam
Rinchinpung
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Kalimpong
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Sookia Pokhari
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Semana Basti
SENCHAL
Mangpu
Birik
Sonada
Sellimbong
Tursum
Sungma
Nagri
Seeyok
Toong
MAMRI RIDGE
Gopaldhara
Okayti
Thurbo
Nigah
Mirik
Namsoo
Kurseong
Gitingy
Nurbong
Sipoydhora
Tindharia
Sukna
Dalling
Mechi R.
Balasan R.
Mal R.
NEPAL
SIKKIM
TIBET
DARJEELING
DALING

NOTES ON THE BIRDS OF THE SIKKIM HIMALAYAS.

By

HERBERT STEVENS, M.B.O.U.

(*With a Map and Plate I*.)

INTRODUCTION.

The Sikkim Himalaya is a compact portion of this enormous mountain range within the limits of latitude 26° 40′ to 28° N., and longitude 88° to 89 E. The whole extent of country represented is a wedge-shaped area, roughly circumscribed to the east by the Cho La Range from Tibet to Bhotan, and on the west by the Singile La Range from Nepal, with a length of 90 miles by 50 miles breadth, in average, representing some 4,500 square miles, and for comparison equivalent to about three-fifths the size of Wales [*] Within these confines is the District of Darjeeling in the Bengal Presidency with its northern frontier adjoining Sikkim and comprising an area of 1,664 square miles, inclusive of the plains tract which is strictly beyond this sphere. Various terms have been employed in the designation of portions of this country, *viz.*, Native Sikkim, in the vernacular, Sukhim, otherwise the Independent State of Sikkim. [†] British Sikhim, as was formerly applied to the range on which stand the hill stations of Darjeeling and Kurseong, together with the contributory spurs originally leased in 1835, but later, with the acquisition of the Southern extremity of the Singile La Range in 1850, had reference to what now constitutes the elevated portion, in contradistinction to the plains of the Darjeeling District. with the exception of what was formerly known as British Bhotan (Daling) annexed in 1864-65, and is now the Sub-Division of Kalimpong. Thus it can be readily understood, how necessary it is to avoid all ambiguous terms in reference to localities and to fix at least the approximate elevations, since even in the district of Darjeeling, there is a difference in altitude of from 300 feet (plains level,) up to Sandakphu at 11,923 feet. The dissimilarities in the physical features of this area exist to a greater degree over the whole country which consists of one extensive complex system of mountains and valleys. In view of these facts I have chosen this term, correctly Sikkim Himalaya, as employed by Hooker, and applicable to this composite territory.

This paper may be regarded as supplementary to my "Notes on the Birds of Upper Assam", Jour. Bom. Nat. Hist. Soc., Vol. XXIII. I have not hesitated to make use of information obtained in outlying parts, as will be noticed; all of which records have a bearing on the subject. It is mainly written from the standpoint of what is now understood as the *Zonal Distribution*, which is an important factor in the fauna and interdependent flora of the two Zoological Regions. It covers my first visit to the hills, March 1911, when elevations of from 2,000′–6,000′ were worked during a stay of twelve days. December 1911 to June 1912, 3,500′–12,000′, a period of twenty-three weeks, of which time from the 20th of January to the 25th of May, my head-quarters were at 10,000′-12,000′. From January 1914, with the exception of a three months' residence at 2,050′ when observations were limited between 950′-2,600′ my eight years' residence at an elevation of 4,720′, with an altitudinal range of some 2,600′ odd feet from 3,440′–6,100′ has supplied the bulk of the records, augmented by every available period of short leave, which has enabled me to widen operations during the winter, when several excursions attaining elevations around 10,000′ have been undertaken into the interior, this being the time when the majority of the birds of the higher limits are then below the prevalent snow-line.

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[*] The size of Wales is 7,362 square miles.

[†] There is no authoritative rendering of this name denoted by either *Sikhim* or *Sikkim*. The latter is most frequently employed and agrees best with Government usage.

These records complete over twenty years' acquaintance with the avi-fauna of the Eastern Himalayas. Full use has been made of information supplied to me by Mr. G. E. Shaw, B.Sc., who also has the advantage of a residential knowledge of a part of the country which presents a marked diversity in the distribution of many species in comparison with my surroundings.

His ornithological pursuits extend over many years. Without the inclusion of his records, these notes would have been incomplete. Where my fellow-planters have assisted me with specimens, acknowledgment is given in the text. My indebtedness is due to Sir Charles A. Bell, K.C.I.E., C.M.G., I.C.S., for, during his regime as Political Officer, granting me facilities to collect in the Independent State of H. H. The Maharajah of Sikkim.

The extraordinary wealth of insect and bird-life is nowhere more exemplified than in this wonderful zoological country, so much so that the great Dr. Alfred Russel Wallace refers to the Himalayan sub-region as perhaps one of the richest tracts of equal extent on the face of the globe.

The list of birds enumerated totals some 549 species and sub-species, and takes scant cognizance of the innumerable waders and ducks, the majority of which pass over as fleeting passage migrants. The Passeres alone number 365 and, as a further instructive example in support of this richness, one 250 acre block of forest has yielded a total of 172 forms with every possibility of an additional dozen or so being added to this number, whilst the surroundings within a radius of one mile have accounted for a supplementary 81 forms. The abundance of bird-life in this particular instance was the result of a favourable situation on a spur, with a northerly and southerly trend within an altitudinal range of from 4,700 feet to over 6,000 feet, whose upper limits extended to meet the Government Reserve. The land at the other extremity and in Nepal being under cultivation or rudely devastated of its natural vegetation has made this area in consequence a perfect "oasis" for the resident birds,in addition attracting the upward breeding migrants and those to and from higher altitudes, as well as stragglers driven down under stress of weather or owing to scarcity of food. The abundance of bird-life in this locality is obvious from a perusal of the following pages. Wherever private enterprise has safe-guarded its interests by conserving even a tithe of the indigenous forest this has all been in favour of the birds, and can well be appreciated by all true lovers of nature's marvellous and bounteous gifts. Where no check has been kept on the primitive methods of land devastation in vogue the ultimate issue has been disastrous in many respects.

Since the first volume of Oates' "Fauna" was published in 1889, our knowledge has advanced on several basis, excepting in regard to Pterylosis. *i.e.*, the study of the distribution of the feather tracts in nestling birds, a branch of Ornithology whose advancement is dependent entirely on the raw material supplied to the systematist by the naturalist in the field, on whose efforts the systematist must also rely for data as regards migration and habits of species—aspects of bird-life whose study has hitherto been sadly neglected. The difficulties attendant on a close study of any of these problems, often under trying circumstances in a tropical climate, ought to be only too apparent, but unfortunately can only be rightly appreciated through actual experience, and can only be overcome by an increase in the ranks of observers with the necessary opportunity and leisure. Nevertheless, progress has been made in the fascinating study of distribution. In gauging the extent to which our present knowledge of the distribution of species is at variance with former records, due regard must be given to the fact that, in the period of time which has elapsed, conditions were not so advantageous for definitely fixing the exact locality and elevation at which species were found, as is necessitated by modern requirements. It must also be remembered that some species have increased and decreased according to whether conditions were favourable or otherwise in areas hitherto frequented by them, for, intensely conservative as birds are, changes in the natural features of the country through man's agency must have produced its effect on the distribution of species. A botanical survey would assuredly reveal a decreased area under forest, while, to go to a greater extreme, specific vegetation which was familiar to Sir Joseph Hooker in his profound knowledge, is no doubt in many instances now relegated to more restricted or remote localities.

CLIMATE.

A humid climate, extending over more than half of the year, has resulted in a luxuriant vegetation. This is the effect not only of the S. W. monsoon which lasts from May to October, the heaviest rainfall generally taking place during the four intervening months, but also of local rain which is more in evidence before the advent of the monsoon, so that in some years, with the exception of an excessive downpour, there is no tangible indication to denote the actual commencement of " the rains ", which are correspondingly prolonged. Whilst the opposing face of the outlying spurs receives the full impact of the deluge, with the consequent result the wettest tract is at the base of the hills, characteristics in the configuration of the physical features cause much disparity in the rainfall which is far from being equally distributed, as for example: Kurseong 154 inches, Darjeeling 120, Gopaldhara 108, Pashok 66. As a short distance around any of these places would give results in excess or in deficit of these figures, it is obvious conditions in the valleys vary in the same respect according to the neighbouring protection, exposure, and slope of the ridges. This never-failing rain exerts its influence on the flora, subject to these several natural peculiarities, which directly affects the fauna. It is during this period of greatest activity in nature, when all insect life is at its zenith, that the majority of the birds perform their duties of procreation, which is none the less remarkable when this heavy rainfall is taken into consideration.

Zoo-Geography.—The exact demarcation of the limits of the Palæarctic and Oriental Regions will remain a matter for modified speculation even with the increase of our knowledge. In deciding on any definite line of division nowhere can this difficulty be more evident than in a country which presents such a diversity in its physical features. Irregularities are bound to occur relative to the varying altitudes of the vegetation, which again is dependent on local peculiarities of soil, aspect and shelter, and this is actually the case, but more strikingly apparent, in the interior, where in the deep narrow valleys the tropical vegetation meets the lowest belt of the temperate flora. Whilst the existence of this division has long since been recognized,opinions may be at variance as to the exact delineation of this divisional line,which can only be considered decisive by a complete zoological survey along the contour of the mountains when the perplexities connected with the presence or absence of forms could be satisfactorily eliminated and, if necessary, the required divergences established.

In view of any misunderstanding which may still be prevalent, it is as well to bear in mind the following statement * which holds as good to-day as when it was originally penned.

" Which class of Animals is of most importance in determining Zoological Regions ?—To decide this question we have to consider which groups of animals are best adapted to exhibit, by their existing distribution, the past changes and present physical condition of the earth's surface ; and at the same time, by the abundance of their remains in the various tertiary formations will best enable us to trace out the more recent of the series of changes, both of the earth's surface and its inhabitants by which the present state of things has been brought about. For this purpose we require a group which shall be dependent for its means of dispersal on the distribution of land and water, and on the presence or absence of lofty mountains, desert plains or plateaux, and great forests; since these are the chief physical features of the earth's surface whose modifications at successive periods we wish to discover. It is also essential that they should not be subject to dispersal by many accidental causes; as this would inevitably in time tend to obliterate the effect of natural barriers, and produce a scattered distribution, the causes of which we could only guess at. Again it is necessary that they should be so highly organized as not to be absolutely dependent on other groups of animals and with so much power of adaptation as to be able to exist in one form or another over the whole globe. And lastly, it is highly important that the whole group should be pretty well known, and that a fairly natural classification, especially of its minor divisions such as families and genera, should have been arrived at; the reason for which last proviso is explained in our next chapter on classification."

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* "The Geographical Distribution of Animals" by A. R. Wallace, 1876. Vol. I. pages 56-58.

"Now in every one of these points the mammalia are pre-eminent; and they possess the additional advantage of being the most highly developed class of organized beings, and that to which we ourselves belong. We should therefore construct our typical or standard zoological regions in the first place from a consideration of the distribution of mammalia, only bringing to our aid the distribution of other groups to determine doubtful points. Regions so established will be most closely in accordance with those long-enduring features of physical geography, on which the distribution of all forms of life fundamentally depend; and all discrepancies in the distribution of other classes of animals must be capable of being explained, either by their exceptional means of dispersion or by special conditions affecting their perpetuation and increase in each locality."

"If these considerations are well founded, the objections of those who study insects or molluscs, for example,—that our regions are not true for their departments of nature—cannot be maintained. For they will find, that a careful consideration of the exceptional means of dispersal and conditions of existence of each group, will explain most of the divergences from the normal distribution of higher animals."

"We shall thus be led to an intelligent comprehension of the phenomena of distribution in all groups, which would not be the case if every specialist formed regions for his own particular study. In many cases we should find that no satisfactory division of the earth could be made to correspond with the distribution of even an entire class: but we should have the coleopterist and the lepidopterist each with his own geography. And even this would probably not suffice, for it is very doubtful if the detailed distribution of the Longicornes, so closely dependent on woody vegetation, could be made to agree with that of the Staphylinidæ or the Carabidæ which abound in many of the most barren regions, or with that of the Scarabeidæ, largely dependent on the presence of herbivorous mammalia. And when each of these enquirers had settled a division of the earth into 'regions' which exhibited with tolerable accuracy the phenomena of distribution of his own group, we should have gained nothing whatever but a very complex mode of exhibiting the bare facts of distribution. We should then have to begin to work out the causes of the divergence of one group from another in this respect; but as each worker would refer to his own set of regions as the type, the whole subject would become involved in inextricable confusion. These considerations seem to make it imperative that one set of "regions" should be established as typical for zoology; and it is hoped the reasons here advanced will satisfy most naturalists that these regions can best be determined, in the first place, by a study of the distribution of the mammalia supplemented in doubtful cases by that of the other vertebrates." Again Wallace writes:—

"I had accepted and supported Dr. P. L. Sclater's division of the earth's surface into six great zoological regions, founded upon a detailed examination of the distribution of birds, but equally applicable to mammalia, reptiles, and several other great divisions, and best serving to illustrate and explain the diversities and apparent contradictions in the distribution of all land animals; and I may now add that the additional facts accumulated and the various divisions suggested during the thirty years that have since elapsed, have not in the least altered my opinions on this matter."

"No one is more aware than myself of the defects of the work, a considerable portion of which are due to the fact that it was written a quarter of a century too soon—at a time when both zoological and palæontological discovery were advancing with great rapidity, while new and improved classifications of some of the great classes and orders were in constant progress. But though many of the details given in these volumes would now require alteration, there is no reason to believe that the great features of the work and general principles established by it will require any important modification.*"

In the treatment of each species separately, stress has been made, in particular instances, of species belonging to Oriental genera having a Palæarctic zonal distribution. Amongst these may be considered, as having a breeding range in satisfactory proof of this contention, the following and, though others might well be included, the undermentioned species fall into this category with a certainty, and thus serve our purpose to the best advantage:—

Hodgson's Fulvetta—*Fulvetta vinipecta vinipecta.*
The Hoary Bar-wing—*Ixops nipalensis nipalensis.*
,, Stripe-throated Yuhina—*Yuhina gularis gularis.*
,, Slaty-headed Yuhina—*Yuhina occipitalis occipitalis.*
,, Green Shrike-Babbler—*Pteruthius xanthochloris xanthochloris.*

to these must be added species not of migratory habits, yet which might be regarded in some quarters as doubtful Palæarctic genera:—

The Rufous-fronted Tit—*Ægithaliscus iouschistos.*
† ,, Great Parrot-Bill—*Conostoma æmodius.*
† ,, Brown Suthora—*Suthora unicolor.*
† ,, Fulvous-fronted Suthora—*Suthora fulvifrons fulvifrons*
,, Black-faced Laughing-Thrush—*Trochalopterum affinis affinis.*
,, Rufous-bellied Pied Woodpecker—*Dryobates hyperythrus hyperythrus.*

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* "My Life", 1905, Vol. II, pages 94 & 98, A. R. Wallace.

† Blanford in his "Notes on the Zoology of the Alpine and Sub-Alpine Regions" states: "Only those species will be noticed which are found above the limit of trees, and consequently no animals will as a rule be mentioned which are not found above 10,000 feet in Northern Sikkim. This elevation, which is about the lower limit of pines, is also a fair approximation to a boundary line between the two faunas which meet in the Eastern Himalayas, the Malay and the Palæarctic" and in reference to *Conostoma aemodius* and *Suthora unicolor* he remarks "Perhaps neither of the last two birds should have been comprised as neither was found above the lowest limit of the pines." Attention has previously been drawn to Blanford's remarks in regard to the demarcation of the two faunas in the Lachung Valley where, at an elevation of 8,000 feet, the south-east slopes of the mountains above Kedom are clothed with the *Abies brunoniana* (Hooker), while at an elevation of 8,300 feet one of the spruce firs, *Abies smithiana* according to the same authority, occurs in the adjoining Lachen Valley in Northern Sikkim.

Crow-Tits and Suthoras which are just as dependent on reed and bamboo-growth as Nutcrackers, Crossbills, &c., &c; are generally considered as occurring exclusively in the pine forests. An extensive tract of matted, dense, impenetrable bamboos is, equally with the superb rhododendron and other stately trees, quite as marked a feature in the vegetation as the pine forests are above. With one exception these birds have this distinct habitat, in respect to which their existence is vital. These peculiar specialized forms are now recognized as belonging to the Palæarctic avi-fauna, and there appears every justification for this inclusion; the presence of *Paradoxornis* at lower levels must be explained by the law of dispersal and these conditions of existence.

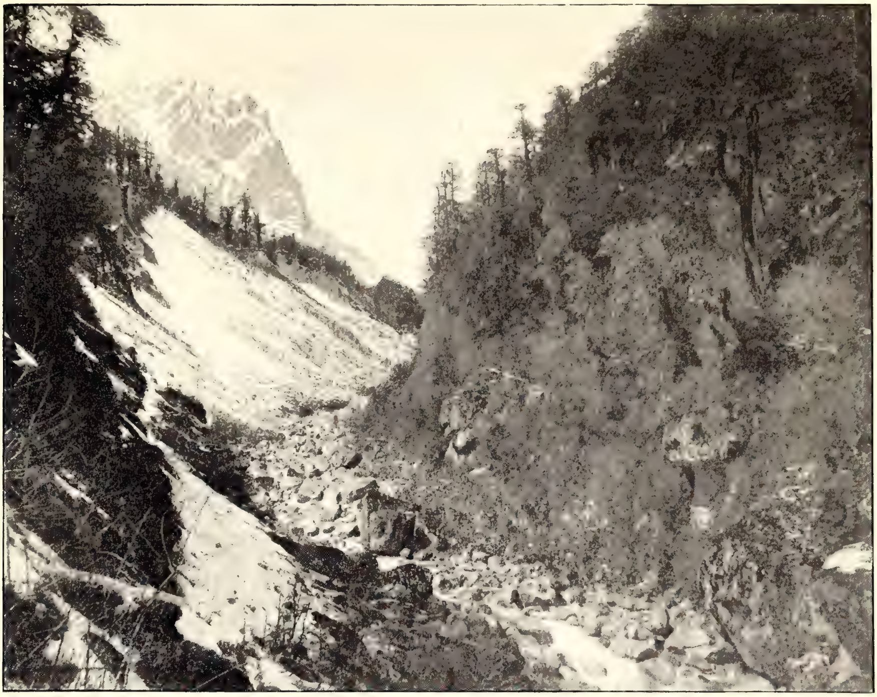
The Darjeeling Pied Woodpecker—*Dryobates darjellensis.*
and finally the bulk of the purely Palæarctic species belonging to undoubted Palæarctic genera, such as
The Himalayan Nutcracker—*Nucifraga hemispila.*
„ Himalayan Cole-Tit—*Lophophanes ater æmodius.*
„ Sikkim Black-Tit—*Lophophanes rufonuchalis beavani.*
„ Brown Crested-Tit—*Lophophanes dichrous dichrous.*
„ Nepal Tree-Creeper—*Certhia familiaris nipalensis.*
„ Nepal Wren—*Troglodytes nipalensis nipalensis.*
„ Himalayan Goldcrest—*Regulus regulus himalayensis.*
and as a representative of the Phasianidæ :—
The Monál—*Lophophorus impejanus* ;
apart from the members of such genera as Pyrrhocorax, Phœnicurus, Calliope, Läiscopus, Prunella, Perissospiza, Pyrrhula, Loxia, Carpodacus, Procarduelis, Grandala, Columba, Ithagenes, &c., &c. ; the majority of which breed at extreme heights in the Himalayas, though the Finches are noted vagrants. I have only taken into consideration the abovementioned non-migratory species as being typical of birds, none of which probably breed below, but at and above the limit of *8,500* feet along the contour of the mountains encircling the main river basin, and as a sufficient illustration for the purpose in defining this division.

The arbitrary boundary between the two zoological regions in the Himalayas has been regarded asfollowing a course at a fixed altitude, and is stated to occur at more or less indefinite limits from 6,000 feet upwards, yet is relative to the vegetation and bears a close connection with *the lowest limits of the coniferous forests,* and is in reality *a belt below the Pines.* It is generally conceded that deciduous forests are singularly deficient in bird-life, " except on the outskirts,"—a scarcity which is a common feature of the pine forests and is substantiated in the numerous instances cited. At whatever elevation the change in the fauna takes place in the N. W. Himalayas, (which is apparently at much lower limits than this definition, and can be accounted for by the lower altitude at which the coniferæ are to be met with) it is certainly not the case in the Sikkim Himalayas, excepting in the valleys of the interior, when, as in the Lachung Valley, a drop in elevation of 2,000 feet reesults in a distinct separation of the two faunas at 6,500 feet.

" The rarity of Pines is perhaps the most curious feature in the botany of Tonglo, and on the outer ranges of Sikkim ; for between the level of 2,500 feet (the upper limit of *P. longifolia*) and 10,000 feet that of the *Taxus,* there is no coniferous tree whatever in Southern Sikkim." (" Himalayan Journals," page 117, J. D. Hooker.)

It will be noted from an examination of the map ; the valleys of the Talung and Ratong have been left open, as information is to some extent meagre as to the exact determination of the dividing line. The first named valley would amply repay working zoologically, but, judging from what we already know of the limits of the tropical vegetation in these valleys, there would almost certainly be found a corresponding marked division in the fauna at a similar altitude as prevails to the north-east having regard also to the close proximity of the snow line. Sir J. D. Hooker makes repeated reference to this phenomenon. Referring to the Ratong Valley from a point south-east of Jongri, he writes:—

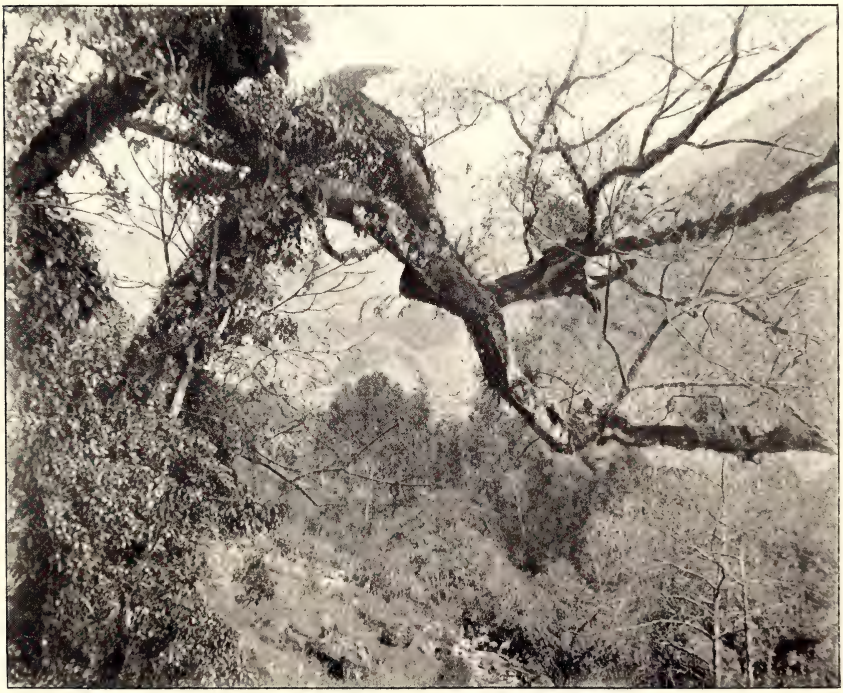
" The view to the southward from Mon Lepcha, including the country between the sea-like plains of India and the loftiest mountain on the globe, is very grand, and neither wanting in variety nor in beauty. From the deep valleys choked with tropical luxuriance to the scanty yak pasturage on the heights above, seems but a step at the first ' coup-d-œil,' but resolves itself on a closer inspection into five belts : 1, palm and plantain ; 2, oak and laurel ; 3, pine ; 4 rhododendron



H. S. Photo.

LACHUNG VALLEY.

Track to Yumthang, four miles north of Lachung, looking north. 7th March, 1920.
"Pine forests devoid of bird-life in winter."



H. S. Photo.

A VISTA OF KEDOM VILLAGE, LACHUNG VALLEY.

11th March, 1920. Elevation 6,500′. The demarcation of the Flora and Fauna of the two Regions is hereabouts strikingly exhibited.

and grass; and 5, rock and snow. From the bed of the Ratong, in which grow palms with screw-pine and plantain, it is only seven miles in a direct line to the perpetual ice. From the plains of India, or outer Himalaya, one may behold snowy peaks rise in the distance behind a foreground of tropical forest; here, on the contrary, all the intermediate phases of vegetation are seen at a glance. Except in the Himalaya this is no common phenomenon, and is owing to the very remarkable depth of the river-beds. That part of the valley of the Ratong where tropical vegetation ceases, is but 4,000 feet above the sea, and though fully fifty miles as the crow flies (and perhaps 200 by the windings of the river) from the plains of India, is only eight in a straight line (and forty by the windings) from the snows which feed that river. In other words the descent is so rapid, that in eight miles the Ratong waters every variety of vegetation, from the lichen of the poles to the palm of the tropics; whilst throughout the remainder of its mountain course, it falls from 4,000 to 300 feet, flowing amongst tropical scenery, through a valley whose flanks rise from 5,000 to 12,000 feet above its bed." (Page 244, and further in reference to the Lachen Valley.)

"Again, the Lachen Valley at this spot is nearly equi-distant from the tropical forests of the Terai and the sterile mountains of Tibet, for which reason representatives both of the dry central Asiatic and Siberian, and of the humid Malayan floras meet there." (Page 313.)

" At first sight it appears incredible that such a limited area, buried in the depths of the Himalaya, should present nearly all the types of the flora of the north temperate zone; not only, however, is this the case, but space is also found at Lamteng for the intercalation of types of a Malayan flora, otherwise wholly foreign to the north temperate region." (" Himalayan Journals," page 314, J. D. Hooker.)

Blanford mentions the lowest limit of the Pines at 500 feet below the village of Lamteng (Lachen) in this valley. The elevation of Lachen is identical with Lachung, 8,800 feet, but the gradient in general of the valley at its lower extremity is less pronounced in comparison to the Lachung Valley.

This line of demarcation isolates three small areas, of which Senchal, the farthest south, affords the severest test. Where the indigenous forest has undergone a certain amount of depletion, to form a correct estimate from this source, however, what formerly existed is fortunately recorded by Hooker; yet the presence of the Red Cat-bear, *Ailurus fulgens,* and the dispersal to much lower limits in the adjacent valleys of typical Palæarctic mammals such as the Tibetan Water-Shrew, *Nectogale sikhimensis,* and the Short-tailed Mole, *Talpa micrura,* (though the last named species has not reached quite the extreme limits of its distribution as it occurs in the plains of Upper Assam and is more common from 3,500 feet upwards in the valleys on the west, which, again, support a Pangolin, *Manis pentadactyla*, evidently not to be met with to the immediate east yet which occurs beyond) are anomalies only to be expected. * Whilst the prevalence in the surroundings during the summer months of such birds as the Brown Suthora *Suthora, unicolor,* Hodgson's Fulvetta, *Fulvetta vinipecta vinipecta,* the Nepal Tree-Creeper, *Certhia familiaris nipalensis,* the Darjeeling Pied Woodpecker, *Dryobates darjellensis,* with the addition of others as for instance, the Sikkim Jay, *Garrulus bispecularis interstinctus,* the Rufous-bellied Shrike-Tit, *Hilarocichla rufiventer,* the Brown Bullfinch, *Pyrrhula nipalensis nipalensis,* and several species which some authorities would, perhaps rightly, have no compunction in including as representing the Palæarctic avifauna, go to prove the correctness of this delineation, which even a strong intermingling of Oriental genera cannot be brought forward to refute; yet some allowance ought to be made for conditions which do not adversely affect to the same extent Tendong to the north.

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* For further information respecting the distribution of the mammalian fauna, consult: R. C., Wroughton, B.N.H.S. Journal, Vol. XXIV, pp. 473, 474.

This attempt may appear to favour of sheer presumption with the numerous difficulties to which attention has been drawn. I crave leniency on the score of "nothing attempted, nothing done" and the labour involved might well have been shirked for other pursuits during my home leave. It rests, however, on a firm basis as, in addition to results obtained from a study of the birds, intensive collecting of the invertebrates has been undertaken by me and I have also had assistance from others and even if many years must elapse before a final conclusion can be drawn from an examination of such a vast amount of material still sufficient evidence has been forthcoming for a satisfactory dividing line, which in places may only be approximately defined but is strikingly apparent in some quarters. Up to the present, so far as I am aware, no endeavour has been made to define the limits ot the two regions in the North-West: a portion of the Himalayas which must be sufficiently well known. If some enthusiast would undertake the task, the generally accepted (straight line) running through this vast range of mountains and innumerable valleys without any regard to the physical features of the country through which it passes, might also show some extraordinary divergences.

As our knowledge is increased of the intervening area, the demarcation of the Oriental fauna in the Eastern and Western sub-regions may not seem an insuperable difficulty as it is at present.

The distribution limits of some species can only be considered provisional and may require modification as years elapse. My opinions are expressed in good faith with no intention of dogmatizing but in the hope that they may be the means of elucidating the correct solution.

Note.—On the completion of these records, Mr. N. B. Kinnear has drawn my attention to an important article which previously was only known to me from references and I am again indebted to Lord Rothschild for the privilege of the use of the Tring Museum Library. The following extracts and remarks anent distribution of species are inserted here, as the former refer to an identical part of the country from which my conclusions were formed, and the latter have been embodied in this paper with a view to completeness as far as it is possible.

"Account of a visit to the Eastern and Northern Frontiers of Independent Sikkim." Pt. I General Account; Jour. As. Soc. Bengal, Vol. XL, 1871, page 367. Pt. II. Zoology; Ibid. Vol. XLI, 1872, page, 30. Dr. W. T. Blanford.

"1870, September 6th.—We marched from Chungtam to Kedam, a short march up the Lachung Valley but involving a considerable ascent, from 5,200 to 6,600 feet. There is a very marked change about this in the fauna and flora. As far as Chungtam the common birds are the usual Sikkim form but at Kedam we found flocks of the Himalayan Siskin, *Chrysomitris spinoides*, and a Titlark, *Corydalla striolata*, abounded in all open spaces. Indeed this may be considered the boundary between the Malay and Palæarctic faunas, a boundary which, on the Chola range, is 3,000 to 4,000 feet higher." (Page 394.)

"15th-20th.—On the 17th we marched down the Tista valley to Tarco on the northern flank of Mount Tendong," "and on the following day we crossed Tendong by a road which goes over the top of the mountain and descended to Namchi, opposite Darjeeling. The change in the fauna in coming southward is very marked, the number of forms increases, and there is a far greater prevalence of Malay types on the outer hills as compared with the upper Tista valley" (Page 420.)

"These elevations and all subsequently mentioned are taken from Hooker's 'Himalayan Journals.' (Blanford.)"

MIGRATION.

Of the actual movement of the Passerine migrants little can be said ; there can be no doubt that in the hills the majority straggle through the valleys in scattered parties or even as individuals. No observer seems to have been fortunate enough to come across a concourse of one species or a mixed assembly on migration. Whether some of the Passerine migrants which perform lengthy journeys pass over at extreme heights during the night has probably not been substantiated by any direct evidence, however this is undoubtedly the case with the waders and ducks. Though there appears to be no well marked migration route through the country the terrific heights of the snowy ranges do not form an insurmountable barrier to birds of comparatively weak flight, as the Mount Everest Expedition has disclosed. Some instances of migration have been recorded under the birds concerned.

VERNACULAR NAMES.

Contrary to what might be expected, the Paharia is not a close observer, confining his attention in particular to the various trees, bamboos, etc. as chiefly concerning his every-day wants. This trait seems to be developed in more primitive people for whereas the Lepcha has a name for each species of bird, the Paharia (which term refers to the hill men Limboos, Newars, Rais, etc. of the Darjeeling district, many of whom now have only remote ties of relationship with the same castes in Nepal) if he does recognize differences, is merely content in relegating birds of similar form and habits under one heading, as his bird vocabulary is very limited. Neither has the younger generation got the grasp of the subject, and the increase of often spurious knowledge, instead of sound common sense education, may have some thing to do with their losing touch with nature. It is unfortunate so few names in the vernacular appear in this list in consequence of this failing.

ACKNOWLEDGMENTS.

An examination of my material would not have been satisfactory without the opportunity to compare obscure and doubtful forms with the two standard collections at home. I am grateful to Lord Rothschild, F.R.S., for granting me access to the magnificent collection in the Tring Museum, and to Dr. E. Hartert and Mr. Arthur Goodson for all kindness and help. My thanks are due to the Authorities of the British Museum for the privilege of the use of the National Collection. I would especially mention Dr. P. R. Lowe, Mr. N. B. Kinnear and Mr. Thomas Wells, and I am under an obligation to Mr. W. S. Millard for his assistance in connection with the publication of this paper and this equally applies to the Editors in seeing it through the press.

As is to be expected the " Fauna" Volumes of Oates and Blanford have formed the grounds of all study. The time seems opportune to express even a belated appreciation of this work before our well worn and stained copies have been laid aside. May every success attend Mr. E. C. Stuart Baker in bringing his task to completion.* Dr. Hartert's "Die Vögel der Paläarktischen Fauna" treats of all the forms occurring in our area. The subject has never been so thoroughly tackled as in this monumental work, which has been freely consulted as also to a less extent " A Manual of Palæarctic Birds " (Dresser). The natural sequence followed is in accordance with Stuart Baker's Hand-List B.N.H.S., Vols. XXVII & XXVIII. References to other important treatises and articles are acknowledged in the text.

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* With the appearance of the 1st Volume of the Second Edition of the " Avi-Fauna " a new era has opened for ornithologists in India and we can well congratulate the author.

The map is a section of the North-Eastern Trans-Frontier, Sheet No. 7. Scale 1 inch=8 miles. Some of the place-names do not agree with the current acceptance, but as it is principally a matter of phonetic spelling, the originals are sometimes more in accord with the local rendering, and it has not been considered advisable or necessary to make any alterations.* Whenever an omission existed, the required locality has been inserted to enable a reference from the text, as no up-to-date map exists, and the inclusion of several such place-names might lead to confusion by giving them undue importance on a map of the present scale, although, it is clear from the numerous omissions, that the tea districts had not reached their importance when this survey was undertaken. The black line represents the demarcation between the Palæarctic and Oriental Regions which is the 8,500 feet contour of the mountain ranges encircling the basin of the Tista River—the main affluent in the country—and its tributaries, with a divergence and drop in elevation to 6,500 feet at the head of the valleys in the interior, the reasons for which are stated elsewhere. All place-names mentioned are underlined as are also Blanford's localities.

Altitudinal records have been obtained by aneroid takings and approximate elevations calculated from authentic heights.

An asterisk denotes an observation.

All measurements are in millimetres unless otherwise stated.

The length measurement of the bill is, in the absence of the other details, taken from the *true base.*

This method is liable to error as the true base is concealed by the feathers of the forehead, and is arrived at with some little difficulty ; it requires careful accuracy and does not seem to be an improvement on the older method of the gape measurement.

An effective and preferable system is to measure from the anterior edge of the nostril to the tip of the bill.

Bill from feathers—Culmen measurement.

All tail measurements are from the commencement of the web, *i.e.*, minus the "quill proper", to the end of the longest feather.

Order—PASSERES.

FAMILY—CORVIDÆ.

1. The Himalayan Raven. Corvus corax tibetanus (Hodgs.).

Recorded for the Himalayas at altitudes, generally of above 13,000′-14,000′ which apparently is applicable to its status in Sikkim. Evidently *confined to high altitudes of the remotest ranges.* In the regions beyond Sikkim probably occurs in the valleys in the winter within its distribution area, as is the case with a number of birds from extreme high limits. From the third week in January to the end of May 1912, at elevations of from 10,000′-12,000′, on the Singile La Ridge during a severe winter, daily observations failed to yield a single occurrence. This prolonged experience is at variance with Beebe's in mid-April, *vide* his reference to this Raven in his field notes on *Ithagenes cruentus* and from the identical tract of country on the Nepal-Sikkim Frontier.

Around Karponang, at 9,500′, during March 1917 when the surrounding country was deep in snow, not a sign of this bird was forthcoming; neither, during a fortnight's sojourn in February and March, 1920, at 8,800′ and upwards beyond the winter snow-line in the Lachung Valley, did a rigorous search of the adjacent mountains produce a single clue to its whereabouts. Information supplied locally to the contrary, as to its frequenting the village during a rigorous winter, I could place no reliance on, as during my stay these conditions were fulfilled without any tangible evidence of its appearance. I have put this negative evidence on record as there is some misconception as to its status. With the Jungle-Crow occupying the wilder tracts of the country, casual observers are apt to confound the two; which is inexcusable if due cognizance is taken of the inequality in size; and it has been reported to me as having been seen, when the bird in question was undoubtedly the next species.

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* Wherever available, the P. O. designation is to be recommended.

The locality Darjeeling, in the absence of any other definite information, should be restricted to the environs of the station. Circum. 7,000 feet.

Blanford states Ravens were not seen below 14,000′, above that were common both on the Cho La Range and in Northern Sikkim in the autumn of 1870 (18th, 19th September, Momay Samdong). During the Mt. Everest Expedition "observed up to 21,000′." Ibis, July 1922, pp. 495-526. "On The Birds collected by Mr. A. F. R. Wollaston during the First Mt. Everest Expedition." (N. B. Kinnear, M.B.O.U.)

2. The Himalayan Jungle-Crow. Corvus coronoides intermedius (Adams). "Kak", Paharia.

Recorded as *absent from the higher parts of the Himalayas,* which is *only correct for extreme limits* in the Sikkim Himalaya—Resident along the Nepal-Sikkim Frontier on the Singile La Ridge, possibly descending to lower limits on the approach of severe weather. During the winter a few pairs hung about the Sandakphu dak bungalow at 11,900′, though they were extremely wary and only one specimen was secured, ♀ 28-2-12. Bill from skull 54, from nostril, 34; wing, 330.

Observed on several occasions when the whole ground was deep in snow. Tonglo, 10,074′, 27-1-12, a single pair in the vicinity of the dak bungalow, having been hereabouts at all events for the last seven days.

Kalo Pokhari, 10,160 , 28-3-12. On my return to camp this evening, I disturbed about forty Jungle-Crows in a patch of forest, mainly rhododendron trees, half a mile below the ridge on the slopes of the Mai ("Khola") Valley in Nepal; they were engaged arranging their domestic affairs and showed their disapproval of my intrusion into their presence by creating a noisy commotion: a clutch of four eggs was taken at this locality on the 27th April 1912. Sparingly nests around Gopaldhara; a clutch of four eggs taken on the 15th May 1912, and on the 24th April 1918, nest in one of the cryptomeria trees alongside the bungalow at 4,720′. Sometimes resorts for this purpose to a high bamboo-clump, when the nest is practically inaccessible. At Karponang was observed frequently at 9,500′ in March 1917. Very common in the village of Lachung and surrounding country at 9,000′ in February and March 1920. Numerous in the station of Darjeeling throughout the whole year.

It would be interesting to have evidence as to whether the Raven ever mingles with the Jungle-Crow at high altitudes or is entirely exclusive in its solitude. I surmise the bird which comes up to breed at "moderate elevations" will on examination prove to be *C.c. levaillanti*, Less.

Blanford states:—Crows were common up to about 13,000′, above which elevation they seemed to be replaced by Ravens, they appeared far more abundant about 8,000′ in the higher valleys than below that elevation; there were large flocks of them near most of the villages, but as usual with *C. vaillanti* ? (*levaillanti*) in the autumn of 1870.

3. The Indian House-Crow. Corvus splendens splendens (Vieill).

More partial to the towns and villages but is distributed sparingly, if somewhat locally, over the whole area. *Occurs up to an elevation of 7,900′* at Jalapahar at all events, though only recorded as ascending the Himalayas to about 4,000′

(Oates, F. B. I., Vol. I.). Chiefly confined to low elevations and not much in evidence; they are however securely established in the station of Darjeeling and the surrounding countryside. Odd birds come up the Rungbong Valley in the cold weather, when they are to be seen around the bungalow at Gopaldhara, 4,720′. Numbers congregated on the Nagri Spur in late January 1919, evidently preparatory to pairing for the nesting season. Observed plentifully in Gangtok at 5,500′ in March 1917. So far I have seen no breeding colonies in these hills but Dr. Scully records examining twenty nests on the 23rd June in the Nepal Valley, when half the number contained young birds.

4. The Black-rumped Magpie. Pica pica bottanensis (Deless.).

Recorded from the higher parts of Bhotan, Native Sikkim and Chinese Tibet. The exact status of this Magpie is unknown to me as I have failed to meet with it in the interior of Sikkim, though it occurs in the Chumbi Valley in Tibet.

5. The Yellow-Billed Blue Magpie. Urocissa flavirostris (Blyth). "Lam Puchari", Paharia.

Resident at Tonglo, Nepal-Sikkim Frontier, *throughout the winter at* 10,000′. One ♂ secured on Sandakphu at 11,000′ on the 3-3-12. Quite a characteristic feature of the bird-life of these high altitudes, to be seen in small parties of six to eight individuals, which forage much on the ground over the steep and rocky mountain slopes. On the frontier hereabouts I did not observe this Long-tailed Pie below 6,500′. On the Semana-Mirik and Sookia-Pokharibong Ridges it comes down *occasionally to 6,000′*, this being an extreme low limit. Sookia-Pokhari, (three miles below) ♂ ♀, 17-4-21.* Kalo-Pokhari, 10,160′, 22-3-12. These birds were most persistent in paying a visit to my camp for the carcase of my specimens; they would hop about my tent door within one or two paces from my feet, and were very voracious, often taking up in their gape three or four large pieces of raw flesh before taking flight.

Lachung, 8,800′. Half a dozen birds haunted the precincts of the village in February and March, 1920. Blanford did not meet with them above 8,000′ at Lachung in the autumn of 1870. This Magpie occurs in East Nepal and it is the only species of this genus I have met with in the Sikkim Himalayas.

Its call is a somewhat pleasing, yet not very pronounced, whistle. Seven specimens examined: ♂ Bill from skull, 37·5–39, av., 38·5; from nostril, 23·25, av., 24·2; wing, 185-195, av., 188·6; longest tail measurement, 385. ♀ Bill from skull, 35-37, av., 36·4; from nostril, 21·5-23, av., 22·4; wing, 178-184, av., 181·5; longest tail measurement, 405.

Soft parts:—♂ Iris, dull yellow "Mottled with brown" in this specimen.

6. The Green Magpie. Cissa chinensis chinensis (Bodd.). "Dhori Koili," Paharia.

Resident in the Rungbong Valley *up to 5,500′* and occurs in the *interior* of Sikkim up to an elevation of *4,750′* at all events. It has a decided preference for dense cover, but when in the open its vivid colours attract attention while on the move from one retreat to another. Its harsh, grating, "peep" "peep", quickly repeated call, however, frequently reveals its position; at times this discordant cry is replaced by a continued distinct and by no means unmelodious whistling chatter. Gopaldhara, 5,400′. Observed on the 1-2-21* in common with other resident birds, when a more congenial elevation might be expected, yet accounted for by the greater area to be covered at the cold season in search of food. "Blue" examples often seen in March. This fact can only be explained on the supposition that such birds are lacking in vigour at a period of the year when a healthy condition should be prevalent; one such coloured individual was observed on the 24-5-14* and again on the 28-5-14*, possibly the same bird, another also on the 7-4-15*.

During the third week and onwards in July 1921, in the Rungbong and Balasan Valleys, the cherry trees were denuded of foliage with an extraordinary plague of caterpillars of the crepuscular moth *Achelura bifasciata*, one of the *Chalcosinæ*.—Family, *Zygænidæ*. A pair of these Magpies were to be seen on occasions in the early morning at Gopaldhara trifling with these blue and yellow banded larvæ, which were evidently too acrid for consumption, as even *Hierococcyx sparverioïdes* was content to leave them at their repast, this being too drastic for its palate. An interesting illustration of the advantage accruing from warning colours and unpalatability amongst the Lepidoptera!

7. The Indian Tree-Pie. Dendrocitta rufa vagabunda (Lath.).

Distribution, as recorded by Oates, Himalayas up to 7,000′.

I have totally failed to meet with this Tree-Pie even at the lowest limits of its supposed range; it certainly *does not occur much beyond the base of the hills*, where it has been obtained at the plains level of 500′ (G.E. Shaw).

In the Eastern Dooars during January 1922 an odd pair or so used to visit the neighbourhood of the Bhotan Ghat forest bungalow on the Raidak River; they were to be commonly met with two miles to the south, in the more open country, beyond the limits of the heavy forest. Only one ♀ adult in clean moulted plumage was secured 29-1-22, which was altogether paler on the back than specimens, (sex and period similar), from the same identical tract of country further to the east in Upper Assam. Notwithstanding this distribution area is applicable to *vagabunda* this specimen is clearly the typical form *D. rufa rufa* (Lath.).

8. The Himalayan Tree-pie. Dendrocitta sinensis himalayensis (Blyth). "Kokila", Paharia.

Commonly occurs in the Rungbong Valley and reaches an elevation of *6,000′*. Noted as equally plentiful around Singhik at an elevation of 4,600′ during February and March in the interior of Sikkim.

9. The Black-browed Tree-Pie. Dendrocitta frontalis McClell.

This species is represented in the Darjeeling Museum, but I have failed to locate this Tree-Pie; it can only be very locally distributed and entirely absent from large tracts, notwithstanding Jerdon's distribution area of 3,000′-5,000′ to the contrary quoted by Oates for Sikkim. Information as to its exact distribution in the Sikkim Himalaya is desirable.

10. The Sikkim Jay. Garrulus bispecularis interstinctus Hartert. "Lho-Khario-pho", Lepcha.

Sparingly and locally distributed. It appears to spread over a wider area on the outer ranges during the winter, but evidently occupies a *breeding range in elevation of from 7,000′-9,000′* or thereabouts.

The following records prove it descends to much lower limits on rare occasions. Kalo Pokhari, 10,160′, ♀ 22-13-12. This single specimen was brought in to my camp along with several *Garrulax albogularis* by a Gurkhali shikari from the Mai ("Khola") Valley in East Nepal, having been obtained at an approximate elevation of 8,500′. Gopaldhara, 6,000′, ♂ ♀ ♀ 2-11-19, obtained out of a party of six individuals. Lachung, ♀ 26-2-20. Two miles south, at an elevation of 9,000′, I came across a small party of which three were noted, but failed to meet with them again in the same Rhododendron forest. Mangpu. ♂ 18-11-19, elevation 3,600′. ♀ 21-11-19, elevation 3,800.′(G.E. Shaw). These two last records are very interesting on account of the extreme low limit reached in its wanderings. In former years obtained above Toong, *circum.* 7,000′ on the Senchal-Kurseong Ridge (H.P.P. Barrett). There can be little doubt that it still occurs in this well wooded part of the district. The Mangpu records certainly refer to birds which have descended from this forest reserve. Single specimens are occasionally to be found in a representative collection from Darjeeling; as the exact locality is seldom definitely stated such examples lose in value. Information as to its present status and exact distribution is desirable and every single record is important, provided it is accompanied with full data.

Five specimens examined : Gopaldhara, ♂, Bill from skull, 30 , from nostril, 19; wing, 167; tarsus, 45; tail, 145. Soft parts : iris, pale brown ; orbits, cinnamon dusky-brown ; tarsus, fleshy-mauve ; claws, similar though darker. The stomach contained pieces of a nut of substantial texture and much sharp white gravel.

♀. Bill from skull, 30 , from nostril, 19·5 ; wing, 165 ; tarsus, 45 ; tail, 147.

♀. Bill damaged ; wing, 165 ; tarsus, 45 ; tail, 145.

Kalo Pokhari, ♀, Bill from skull, 29 , from nostril, 18·5 ; wing, 164 ; tarsus, 44 ; tail, 145.

Lachung, ♀, Bill from skull, 30 , from nostril, 19 ; wing, 172 ; tarsus, 43 ; tail 160.

This last specimen has not the deep tone in coloration of the other four specimens ; it is paler on the forehead and crown, and has the back suffused with a vinaceous wash. The measurements almost point to a large race in the interior of Sikkim, but no definite result can be arrived at from this single specimen. Soft parts : Iris, hazel with a faint indication of an outer blue ring ; tarsus, fleshy.

11. The Himalayan Nutcracker. Nucifraga caryocatactes hemispila. (Vig.). " Lek Bhali ", Paharia.

Generally distributed, equally plentiful on the outer ranges as it is in the interior. Blanford found it rare on the outer ranges in the autumn of 1870. *Resident from 9,000′-10,000′.* On the Nepal Frontier it was " absent from the Pine forests in the winter " early 1912 when they were *breeding in a belt of forest below the pines.* The grating " cra "of this Nutcracker is quite a characteristic call of these high altitudes. Observed frequently around Karponang at 9,500′ but the majority of the birds were below this elevation in March 1917. Above Lachung at 10,000′ in March 1920 they were very noisy on the outskirts of the pine forests. I could detect no signs of breeding having actually commenced in sexing the birds obtained. Tonglo, Singile La Ridge, 10,000′, ♂, 9-2-12, one of a pair, testes active, evidently an early nesting species, but this specimen is the first obtained that gave any indication of this surmise. Kalo Pokhari, 28-3-12, an adult and fully fledged youngster taken at the nest near at hand, in Nepal, at an elevation of 9,500′ approx. below the pine forests, remarked upon at the time as an unsual ? early date, and the single fledgling as significant of this fact, heavy falls of snow at this time. 10,000′, ♀ 28-4-12, immature, in mottled plumage, showing the white, pear-shaped spots extending over the complete under surface. ♂ Adult, 23-5-12, undergoing moult, the new dark feathers on the breast are prominent. It evidently breeds at an earlier period of the year on the outer ranges than it does in the interior.

Eleven specimen examined :—all adults.

♂ Bill from skull, 46§-51·5, av., 48·9 ; from nostril, 34-39, av., 36·2.

♀ Bill from skull, 43§-49, av., 45·7 ; from nostril, 31-37·5, av., 33·5.

♂ Wing, 210-229, av., 220·5. ♀ wing, 211-220, av., 214·6.

Four ♂ ♂ and one ♀ show the white spot on the seventh primary ; these in common with the rest are fully adult.

Soft parts.—Iris, dark brown ; bill and tarsus, black.

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§ The bill is worn to a chisel point in these two examples.

12. **The Himalayan Red-billed Chough. Pyrrhocorax pyrrhocorax** (Linn.). " Chumboo " Lepcha.

Confined to the far interior. Found in the *valleys in the winter.* Lachung, 8,800′, 27-2-20—11-3-20, flock of not less than one hundred and fifty birds used to fly almost daily, from the surrounding mountains on the south-east of the village, and settle in and about the scantily cultivated barley fields and adjacent rocky ground of the village, where they busily set to work probing their bills deep down into the ground for food. On occasions they came within a few feet of the dak bungalow, affording me a never-ending source of pleasure in watching all their varied actions; sometimes two male birds would come to blows, to the apparent indifference of a member of the other sex. The advent of a Jungle-Crow to add his quota of pecks to the unfortunate bird which was getting the worse of the encounter, notwithstanding its determination to continue the fight whilst sprawling on its back, necessitated my interference to end the fracas. I had to leave all preparation of skins and drive them away; no doubt the quarrel was commenced again in some more secluded spot. When the ground was under snow they would betake themselves a few miles further south down the valley, to work their way back leisurely, along either side of the rocky mountain slopes, always uttering their usual plaintive call. It is a matter for congratulation that there has evidently been no decrease in their numbers in the interior since Hooker in May 1849, recorded the Red-billed Crows around the village of Lachen (Lamteng), at a similar elevation in the valley to the west. Blanford has recorded it up to 16,000′, but speaks of it as rather scarce on the Cho La Range. During the Mt. Everest expedition " observed at 20,000′ in September." (A.F.R. Wollaston).

Two specimens examined :
♂ Bill from nostril 56 ; wing, 313 ; tarsus, 66.
♀ Bill from nostril, 51 ; wing, 303 ; tarsus, 58.

Soft parts : iris, dark brown ; bill and tarsus, blood-red tinged with mauve ; claws, black.

While birds of these large dimensions occur in other parts of the Palaearctic Region, specimens from Turkestan, which area might be consistently taken as a centre of its distribution, are appreciably smaller ; this seems to be a good reason for regarding this large race from the Himalayas as distinct. I am confident a large series of sexed specimens would sustain my contention, as this race is more or less isolated in its distribution area. Unfortunately no definite result can be arrived at from my meagre material, I have also only two specimens from Turkestan for comparison.
♂ Bill from nostril, 38 ; wing, 288 ; tarsus, 53.
♀ Bill from nostril, 41 ; wing, 274 ; tarsus, 51.

13. **The Yellow-billed Chough. Pyrrhocorax graculus** (Linn.).

Recorded for the Himalayas, " low down in winter, 15,000′ or higher in summer appears to move locally according to season."

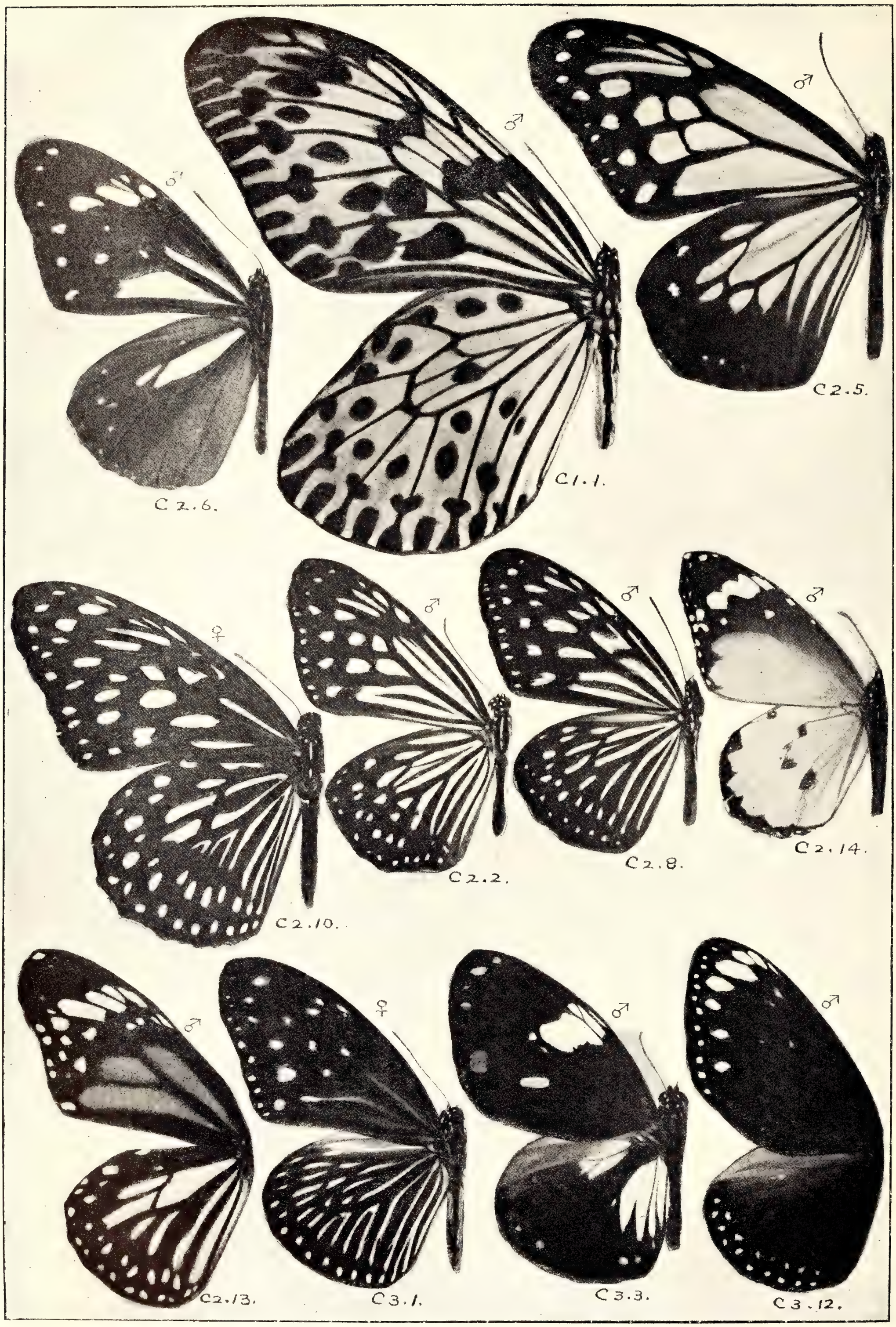
Sandakphu, Singile La Ridge, Nepal side of the frontier at 11,850,′ 6-3-12. Ten Yellow-billed Choughs came slowly up from the valley below, beating along one of the spurs of the south face of the mountain ; they sailed overhead in close proximity to me, settling alternately on the low bushes and rocks, hopping about the ground in the beds of the gullies on the steep, rocky slopes, and were most fearless, occasionally uttering a weird, plaintive call. Several Jungle-Crown evidently jealous at these arrivals in their own domain, where food was none, too plenty to support such an influx of competitors, mingled with the party ;

whilst there was no actual molestation noticeable, it was obvious they were not welcomed. Observed several days later on the western face of the mountain when they were very shy, in some measure due to the howling, west winds, which were then prevalent, and not conducive to prolonged and peaceful foraging.

Kalo Pokhari, 10,160′, 14-4-12*. Twelve Yellow-billed Choughs passed overhead this morning, heading south. This fact would almost point to severe weather at hand, incessant rain yesterday, to-day dull and foggy, most depressing conditions. My fears were soon to be realized as the wind veered round during the night, with the result my camp was buried in snow next morning to a depth of two feet. I was curious to know how far they descended but unable to carry out the necessary search.

Lachung, 9,000′. A few pairs haunted the steep face of the mountains on the west of the village during the last week in February and first week in March 1920, after which they disappeared. On no occasion were they to be seen in the precincts of the village; which ground was left in entire possession of Jungle-Crows and Red-billed Choughs. Blanford remarks on this fact and the disparity of their numbers. During the Mt. Everest Expedition "observed up to 20,000′" (A.F.R. Wollaston).

(*To be continued.*)


♂
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C2.6.
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C2.14.
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♂
C2.13.
C3.1.
C3.3.
C3.12.

C. **Danaidae.** 1. *Hestia*: 2. *Danais*: 3. *Euploea*.

THE IDENTIFICATION OF INDIAN BUTTERFLIES.

By Lieut-Col. W. H. Evans, D.S.O., R.E., F.Z.S., F.E.S.

(*Continued from page* 260 *of this Volume*).

Part II.

(*With three plates*).

C. Danaidæ.—The Danaids.

1a (3). H v8 not parallel to v7 and meets costa about origin v7.

1 (2). H pcv from beyond origin v8 ; v6 nearer 5 and 5 nearer 4 ; dcv 5-4 perpendicular. No. ♂ brand. Claws with appendages. Antennæ filiform.

Hestia, Hub. The Tree-Nymphs. (Plate 10).

2 (1). H pcv from origin v8 ; v6 nearer 7. With male brand. Claws with appendages. Antennæ more or less clubbed.

Danais, Lat. The Tigers. (Plate 10).

3 (1a). H v8 parallel to v7 and far from costa opposite origin v7 ; v6 nearer 7 ; v5 equidistant between 6 and 4 ; dcv 5-4 inclined. With ♂ brand. Antennæ clubbed.

Euploea, F. The Crows. (Plates 10 & 11).

C1. Hestia.—The Tree-Nymphs. (Plate 10).

1 (2a). F costa prominently black at end v12 ; spots mid cell not zigzag v10 from just before end cell.

α. Smoky. F discal spots beyond end cell separate ; spot mid cell joined to spot above it.

* *lynceus jasonia Wd.* (120-140). The Ceylon Tree Nymph. Ceylon. NR.

β. As α, spot mid cell separate from spot above it.

lynceus malabarica, M. (120-160). The Malabar Tree-Nymph. Travancore—Nilgiris. NR.

γ. As β but diaphanous white and smaller.

lynceus kanarensis, M. (120-140). The Kanara Tree-Nymph. N. Kanara. NR.

δ. Yellowish. F discal spots conjoined.

lynceus arracana, Fruh. (110-130). The Arracan Tree-Nymph. Sunderbans—N. Burma. R.

As δ but apex F and margins F & H broad black unspotted.

lynceus hadeni, WM. (120-140). The Bassein Tree-Nymph. Bassein. R.

ξ. As δ but marginal spots H separate, not confluent.

lynceus agarmarschana, Fd. The Tavoy Tree-Nymph. Moulmein—S. Burma. NR.

ε. As ξ, but smoky and black markings wider ; H 3 equal black spots in 7.

lynceus cadelli, W.M. The Andaman Tree-Nymph. Andamans. NR.

β. Very similar to α. *lynceus reinwardtii, M.* Mergui. V.R.

2a (1). F costa not prominently black at the end of v12 ; spots in mid cell zigzag. Termens F & H evenly convex.

2 (3). Uph detached marginal spots arranged as in No. 1.

hypermnestra linteata, But. (140-160). The Malayan Tree-Nymph. Mergui. VR.

3 (2). Uph black border bearing large white spots.

leuconœ siamensis, God. (120-160). The Siam Tree-Nymph. Victoria Point. VR.

C2. Danais.—The Tigers. (Plate 10).

1a (8a). H v5 nearer 4; dcv 5-4 perpendicular. Black with pale blue to white markings. F pale area in cell unbroken transversely; in 2 there are 3 single spots followed by 2 marginal spots which are sometimes obsolete.

1b (4a). ♂ uph large pouch on v2 near margin and smaller one on v1. F cell pale with a dark streak.

1 (2a). Uph 2 detached or conjoined spots in the middle of 6.

α. Pale markings restricted. Upf and uph marginal spots obsolete at apex.

aglea aglea, Cr. (70-85). The Glassy Tiger. Ceylon. S. India. C.

β. Pale markings more extensive and marginal spots complete.

aglea melanoides, M. Kashmir—Burma. C.

γ. Pale marginal markings restricted, discal extensive; H basal spots in 2 & 3 conjoined to discal.

aglea melanoleuca, M. Andamans. C.

2a (1). Uph single spot mid 6.

2 (3). Above uniform. H cell with dark streak.

**agleoides, Fd.* (70-75). The Dark Glassy Tiger. Rangoon—S. Burma. Nicobars. NR.

3 (2). H basal half yellow; cell immaculate.

aspasia, F. (75-85). The Yellow Glassy Tiger. Burma. R.

4a (1b). ♂. uph large pouch on v1 near margin and smaller one on v1a.

4b (6). F cell immaculate.

4 (5). Uph margin broad dark chocolate, prominently white spotted.

melaneus plateniston, Fruh. (85-95). The Chocolate Tiger. Sikkim—Burma. Nicobars. C.

5 (4). Uph margin bright chestnut, obscurely spotted.

α. Pale markings extensive. F basal and discal spots in 2 and 3 conjoined.

tytia sita, Koll. (85-105). The Chestnut Tiger Kashmir—Kumaon. NR.

β, Pale markings more restricted. F basal and discal spots in 2 and 3 well separated.

**tytia tytia, Guer.* Sikkim—Burma. NR.

6a (4b). F and H cell dark with a pale streak.

6 (7). H very sparsely marked, no pale streaks between cell and dorsum.

**fumata, But.* (85-95). The Ceylon Tiger. Ceylon. NR.

7 (6). H more marked, with long pale streaks between cell and dorsum.

nilgiriensis, M. (80-90). The Nilgiri Tiger. S. India. NR.

8a (1a). H v5 nearer 6 than 4 or equidistant; dcv 5-4 inclined.

8 (9a). F vs 11 and 12 anastomosed. No ♂ brand except that v1 F is thickened and runs in a channel. Black with pale blue markings. F pale streak in cell divided transversely; in 2 there is a single basal and central spot, followed by 2 marginal spots.

α H prominent streak in cell. Markings wide; streaks beyond cell very wide.

similis exprompta, But. (75-85). The Blue Glassy Tiger. Ceylon. NR.

β. All markings narower.

**similis vulgaris, But.* Bassein—S. Burma. C.

γ. H cell not streaked. Markings very wide.

similis nicobarica, WM. Nicobars. R.

9a (8). F vs 11 and 12 free and parallel.

9b (12a). ♂ uph pendulous pouch in 1 shortly after origin v2. Black with pale blue markings; F pale streak in cell divided transversely; in 2 there is a large basal, 2 central and 2 marginal spots.

9c (11). F no pale streak from base cell along costal vein.

9 (10). F width of streaks beyond end cell not less than half their length.

C2. Danais—The Tigers. (Plate 10).—*contd.*

limniace mutina, Fruh. (90—100). The Blue Tiger. Ceylon, India, Burma, Nicobars. VC.

10 (9). F width of streaks beyond end cell much less than half their length.

a. Small with narrow markings.

melissa musikanos, Fruh. (85—95). The Dark Blue Tiger. Ceylon. NR.

β. Small, markings wide and pale.

**melissa dravidarum. Fruh.* S. India. NR.

γ. Large. F produced. Markings narrower and much darker.

melissa septentrionis, But. (90—105). Kulu—Burma. C.

11 (9c). F pale streak from base cell along costal vein.

a. This streak prominent, nearly as long as the streak along the median vein.

gautama gautama, M. (90—100). The Scarce Blue Tiger. Burma. R.

β. This streak very short. Smaller.

gautama gautamoides, Doh. (75—85). Nicobars. R.

12a (9b). ♂ uph with pouch below v2 shortly after its origin. Tawny.

12b (14). Veins black.

12 (13). H tawny.

plexippus, L. (75—95). The Common Tiger. Ceylon. India. Burma. Nicobars. VC.

13 (12). H white.

a. Pale markings extensive.

**melanippus indicus, Fruh.* (80—95). The White Tiger. Bengal Burma. C.

β. Pale markings reduced ; H no white sport near base 6.

melanippus nesippus, Fd. Nicobars. C.

14 (12b). Veins not black.

**chrysippus, L.* (70—80). The Plain Tiger. Ceylon, India, Burma, Andamans, Nicobars. VC.

v. alcippus, Cr. Uph more or less white. VR.

v. dorippus, Cr. Upf white spotted black apex absent. R.

C3. Euplœa.—The Crows. (Plates 10 & 11).

1a (12a). ♂ uph with an area containing modified scales.

1b (3a). This area is black or dark brown and fills upper outer angle of cell and more than half of spaces 4-6. Unh 2 well separated streaks or spots in 4.

1 (2). ♂ uph small yellow brand base 6 ; no brand upf ; unf yellow brand about v1 near base ; dorsum F slightly bowed. Upf blue shot and blue or white spotted.

a. ♀ uph no white streaks in cell. ♂ upf spots white.

mulciber kalinga, Doh. (90—100). The Striped Blue Crow. Madras—Bengal. R.

β. ♀ uph white streaks over whole wing. ♂ upf spots blue.

**mulciber mulciber, Cr.* Simla—Burma. VC.

2 (1). ♂ uph no brand ; upf prominent long brand mid 1 ; dorsum F much bowed. Unf no spot base 6. ♂ upf velvet black, very obscurely blue shot. unspotted ; ♀ dark brown with few white spots. Uph postdiscal spots elongated into long streaks.

a. Uph white streaks long.

alcathœ doubledayi, Fd. (85—100). The Striped Black Crow. Sikkim—Shan States. NR.

β. Uph white streaks restricted, especially in ♂, where they are dusky.

alcathœ œsatia, Fruh. Karens—S. Burma. NR.

3a (1b). ♂ uph modified area yellow or dark brown, confined to a brand at upper outer angle of cell and extending at most into bases of 5-7 ; unf a yellow area of modified scales about v1 near base ; dorsum F much bowed.

C3. Euplœa.—The Crows. (Plates 10 & 11).—*contd.*

3b (5a). Uph with spots at bases 2 and 3 and usually 4. (see No. 6ξ.)

3 (4). Upf very large white spot end cell, extending to costa and uph with white streaks below cell. Blue shot and blue brand in 1.

α. Uph white markings more extensive; in ♂ enters base 3.

diocletiana ramsayi, M. (80—90). The Magpie Crow. Sikkim—Assam. NR.

β. Uph white markings restricted; in ♂ not into base 3.

**diocletiana diocletiana, F.* Assam—Burma. C.

4 (3). Upf very small spot end cell and uph no white streaks. ♂ upf no brand; H termen straight and end cell much nearer termen than usual; lower part termen broadly greasy. Not blue shot. Very large.

α. Upf apical spots no larger than the discal.

corus corus, F. (110—130). The Great Crow. Ceylon. NR.

β. Upf apex suffused broad lilac.

corus vitrina, Fruh. Bassein. R.

γ. Upf apical spots much larger than the discal.

**corus phœbus, But.* Moulmein—S. Burma. Nicobars. R.

5a (3b). Uph never with spots at bases 2, 3 and 4. (except No. 6ξ).

5b (8a) Unh no spot base 3. (except No. 6ξ).

5 (6a). ♂ upf no brand; H shaped as in No. 4. Upf marginal spots absent; postdiscal spots blue, coalesced at apex in 6 and 7. Blue shot; lower area F and all H pale brown.

mazares ledereri, Fd. (70—80). The Dwarf Crow. S. Burma. R.

6a (5). ♂ upf short brand.

6 (7). This brand dark brown.

α. Not blue shot. Upf marginal spots obsolete, postdiscal spots not enlarged at apex; no discal spots.

klugii sinhala, M. (85—100). The King Crow. Ceylon. R.

β. As α but marginal spots present upf.

klugi kollari, Fd. S. India—Bengal. R.

γ. Blue shot. Upf marginal and postdiscal spots small, white and discal spots usually absent.

klugii klugii, M. Sikkim. R.

δ. As γ, very variable. Upf spots blueish and discal spots usually present.

klugii macclellandi, M. Assam—N. Burma. NR.

β. Rarely very obscurely blue shot basally. Upf marginal spots present; postdiscal spots enlarged at apex, discal spots present or absent.

klugii crassa, But. Chin Hills—S. Burma. NR.

η. Pale brown, not blue shot. Upf discal spots very prominent and post disξcal spot enlarged at apex. Very like No. 13.

klugii rœpstorfii, M. Andamans. VR.

7 (6). ♂ upf brand blue. Blue shot and blue spots upf present or absent. H rather pale brown.

ι. Uph marginal spots more or less well developed.

leucostictos leucogonys, But. (90—110). The Blue-branded King Crow. S. Burma. VR.

β. Uph marginal spots obsolete.

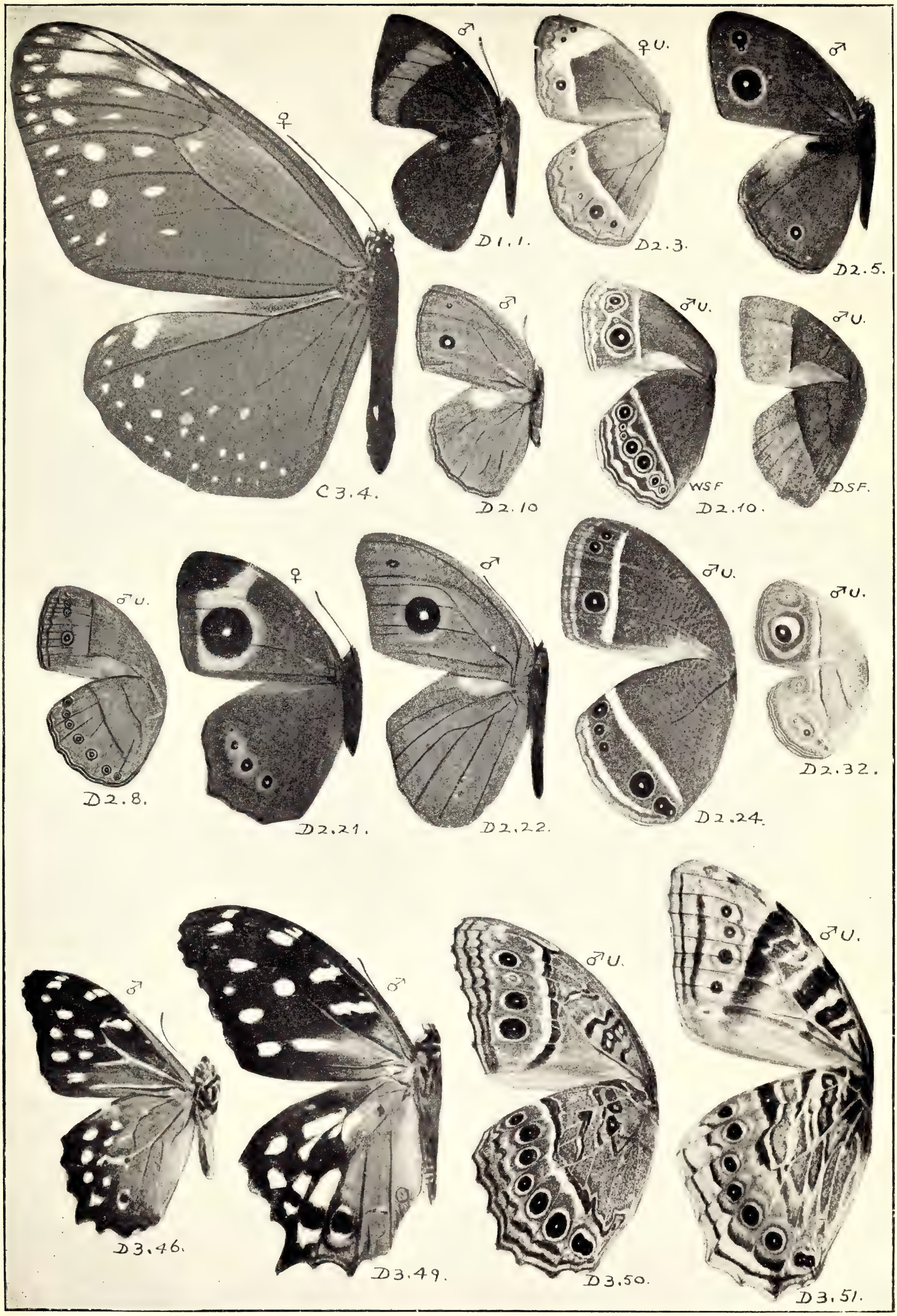
leucostictos novarœ, Fd. Nicobars. R.

8a (5b). Unh always a spot in cell and base 3.

8 (9a). Upf spot end cell blue, also those beyond, if present. ♂ upf very long dark brown brand.

α. Upf blue shot nearly to termen. Uph marginal and sub-marginal spots obsolete.

midamus splendens, But. (95—105). The Blue-spotted Crow. Sikkim—Shan States. R.


♀
C 3.4.
♂
D 1.1.
♀ U.
D 2.3.
♂
D 2.5.
♂
D 2.10
♂ U.
WSF
D 2.10.
♂ U.
DSF.
♂ U.
D 2.8.
♀
D 2.21.
♂
D 2.22.
♂ U.
D 2.24.
♂ U.
D 2.32.
♂
D 3.46.
♂
D 3.49.
♂ U.
D 3.50.
♂ U.
D 3.51.

C. **Danaidae.** 3. *Euploea.*
D. **Satyridae.** 1. *Mandarinia* : 2. *Mycalesis* : 3. *Lethe.*

C3. Euplœa.—The Crows. (Plates 10 & 11).—*contd.*

β. Basal two-thirds blue shot. Uph marginal and sub-marginal spots more or less well developed.

midamus brahma, M. Karens—S. Burma. NR.

9a (8). Upf spot end cell, if present, white.

9 (10a). Not blue shot. Outwardly conspicuous pale brown. Unspotted above except for a costal and a few discal spots F. in ♀. ♂ upf with or without a small dark brand, appearing unf as a long white streak above the yellow area.

scherzeri, Fd. (95—100). The Cinnamon Crow. Nicobars. NR.

10a (9). Blue-shot. Uph marginal and sub-marginal spots prominent; upf obsolete or nearly so, never a spot in cell and usually only on costa and in 3, also small apical spot in 6 and 7. ♂ upf no brand, but present unf on the yellow area.

10 (11). H not blue-shot.

modesta, But. (80—95). The Plain Blue Crow. Dawnas—S. Burma. C.

11 (10). H blue glossed.

camaralzaman, But. (110—120). The Large Blue Crow. Tavoy—S. Burma. VR.

12a (1a). Uph no area of modified scales.

12b (17a). ♂ upf a single brand or none.

12c (16). Not or only very obscurely blue-shot.

12 (13a). Upf usually only a single marginal and postdiscal spot in 1. ♂ upf brand rarely present; dorsum F much bowed.

a. F marginal and discal spots complete, latter much enlarged at the apex.

**crameri bremeri, Fd.* (85—95). The Spotted Black Crow. Akyab—S. Burma. C.

β. Very variable. Upf marginal and discal spots less developed, discal spots in 6-8 absent or small.

crameri frauenfeldii, Fd. Nicobars. NR.

13a (12). Upf usually and unf always 2 marginal and 1 discal spot in 1.

13 (14a). Upf spot in cell and discal spots in 2 and 3 very prominent. Pale brown. ♂ upf brand prominent, dorsum much bowed.

andamanensis, Atk. (85—95). The Andaman Crow. Andamans. NR.

14a (13). Upf spot in cell and discal spots in 2 and 3 absent or obscure.

14 (15). Upf apex violet, postdiscal spots, obscure or absent and marginal ones very small, always a spot base 3. ♂ brand prominent, dorsum somewhat bowed.

godartii, Lucas. (85—95). The Violet-tipped Crow. C.

15 (14). Upf apex plain; postdiscal spots present. ♂ brand upf rather obscure and rarely absent, dorsum slightly bowed.

a. Upf marginal spots nearly obsolete, postdiscal becoming obsolete towards apex, never a spot at base 3.

core asela, M. (85—95). The Common Indian Crow. Ceylon. VC.

β. Upf marginal and postdiscal spots prominent, latter more or less equal or decrease slightly to apex; no spot base 3.

core core, Cr. India to Himalayas. VC.

γ. As *β* but postdiscal spots increase in size towards apex; often a spot base 3.

core vermiculata, But. N. India—Assam. VC.

δ. Upf spotting mean between *a* and *β*; outer third conspicuously paler.

core layardi, Druce. Akyab—S. Burma. R.

16 (12c). Above blue shot. Upf no marginal or postdiscal spots, rarely white spot in cell, usually one base 3 and sometimes base 2. ♂ upf very long prominent brand, dorsum slightly bowed.

a. Uph marginal and sub-marginal spots incomplete or absent.

C3. Euplœa.—The Crows. (Plates 10 & 11).—*contd.*

deione deione, Wd. (95—105). The Long-branded Blue Crow. Sikkim—Shan States. NR.

β. Uph marginal and sub-marginal spots prominent and complete.

deione limborgii, M. Karens—Mergui. NR.

γ. Upf blue much darker; uph sub-marginal spots elongated.

deione menetriesii, Fd. Extreme S. Burma. VR.

17a (12b). ♂ upf 2 prominent brands. Unf always spot base 6, which is more prominent than the spots in 5 and 4, if latter are present.

17 (18). Upf blue-shot and blue spotted.

a. Upf sub-marginal spots large, discal spots usually present.

Uph sub-marginal and marginal spots usually incomplete.

harrisi hopei, Fd. (95—105). The Double-branded Blue Crow. Sikkim—Shan States. NR.

β. Upf sub-marginal spots small, no discal spots; uph sub-marginal and marginal spots prominent.

harrisi harrisi, Fd. Karen Hills—S. Burma. NR.

18 (19). Above not blue-shot.

a. Upf sub-marginal spots reduced, becoming obsolete at apex.

coreta montana, Fd. (85—95). The Double-branded Black Crow. Ceylon. NR.

β. Upf sub-marginal spots prominent.

coreta coreta, God. S. India. NR.

D. Satyridæ.—The Satyrids.

1a (6a). Eyes hairy.

1 (2a). Palpi with appressed hairs. F no veins swollen; upper apex cell obtusely rounded; v10 from cell. H v3 from well before end cell.

Mandarinia, Leech. The Mandarin. (Plate. 11).

2a (1). Palpi with porrect hairs. F v12 swollen.

2 (3a). F v1 and mv swollen; upper apex of cell highly acute and dcv angled.

Mycalesis, Hub. The Bushbrowns. (Plate. 11.)

3a (2). F v1 not swollen, mv more or less swollen.

3b (5). H vs 7 and 6 well separated at origin.

3 (4). H never symmetrical about a central axis from the base to the middle of the termen, nor is termen convex between vs 4 to 6; apex may be angled, costa straight, termen caudate at v4, tornus excavate before v2; very variable.

Lethe, Hub. The Treebrowns. (Plates. 11—12).

4 (3). H symmetrical about a central axis, apex, termen and tornus evenly rounded.

Pararge, Hub. The Walls. (Plate. 12).

5 (3b). H vs 7 and 6 close at origin. F upper apex cell highly acute and dcvs angled. H v3 from before v4.

Orinoma, Gray. The Tigerbrowns. (Plate 12).

6a (1a). Eyes smooth.

6b (25). H no prediscoidal cell.

6c (20a). F mv swollen.

6d (19). Palpi with porrect hairs. H v3 from before and cell.

6e (16a). F upper end cell not longer than lower end.

6f (15). H v8 highly angled at origin, meets scv more or less at right angles.

6 (7a). F v1, mv and v12 prominently swollen. F upper apex cell acute. Antennæ club spatulate.

Cœnonympha, Hub. The Heaths.

7a (6). F v1 not prominently swollen.

7b (9a). F mv prominently swollen ; lower dcv convex.

D. Satyridæ.—The Satyrids.—*contd.*

7 (8). F upper apex cell acute.

Maniola, Schrank. The Meadowbrowns. (Plate 13).

8 (7). F upper apex cell right angled.

Eumenis, Hub. The Rockbrowns. (Plate 13).

9a (7b). F mv not swollen. (except some *Ypthimas,* but they have the lower dcv F straight or concave).

9b (13a). H termen more or less crenulate and cilia, at least on F, prominently chequered.

9 (10a). F cell short and broad; v4 curved , ♂ upf brand.

9c (12). H upper dcv 5-6 concave at upper end. Unh no ocelli.

Karanasa, M. The Satyrs. (Plate 13).

10a (9). F cell longer than half the wing ; v4 straight.

10 (11). Above tawny; no ♂ brand.

Parœneis, M. The Mountain Satyrs, (Plate 13).

11 (10). Above black: upf ♂ brand.

Aulocera, But. The Banded Satyrs. (Plate 13.)

12 (9). H upper dcv 5-6 straight. Unh with ocelli.

Arge, Hub. The Marbled Whites. (Plate 13).

13a (9b). H termen not crenulate and cilia not chequered (except slightly in some Erebias).

13 (14). F lower dcv convex, v10 arises from cell (except in some Palæarctic species).

Erebia, Dal. The Arguses. (Plate 13)

14 (13). F lower dcv straight or concave; v10 always from v7.

Ypthima, Hub. The Rings. (Plate 13).

15 (6f). H v1 nearly straight at origin, meets scv at an acute angle. F upper apex cell right angled. No male brand.

Zipœtis, Hew. The Cats-eyes. (Plate 13).

16a (6c). F upper end cell markedly longer than the lower end ; upper apex cell highly acute.

16b (18). H normal. F v10 from cell.

16 (17). H vs 3 and 4 approximate at origin. F lower dcv highly concave

Orsotriœna, Wallen. The Niggers. (Plate 13).

17 (16). H vs 3 & 4 well separated at origin. F lower dcv straight. No male brand.

Erites, Wd. The Cyclops. (Plate 13).

18 (16b). H abnormal, vs 7 & 6 forked long after origin v5, which arises shortly after origin v8; dcv represented by an ill-developed vein from origin v2 to scv before origin v5 and in ♂ this dcv is replaced by a narrow channel, not reaching the scv and covered by a recumbent tuft of black hairs. F v10 from v7.

Ragadia, Wd. The Striped Ringlets. (Plate 13).

19 (6d). Palpi with appressed hairs. F upper apex cell acute.

Cœlites, Bdv. The Blue Catseyes. (Plate 14).

20a (6c). F no veins swollen.

20 (21a). Palpi with porrect hairs. F upper apex cell right angled. H v3 from end cell.

Neorina, Wd. The Owls. (Plate 14).

21a (20). Palpi with appressed hairs.

21 (22a). H v3 from just before end cell. F upper apex cell right angled, lower dcv straight; v10 from cell. No male brand.

Anadebis, But. The Diadems. (Plate 14).

22a (21). H v3 from well before end cell. F upper apex cell rather acute, lower dcv concave.

22b (24). F.v10 from cell.

D. Satyridæ.—The Satyrids.—*contd.*

22 (23). F v1 ends on termen ; v5 nearer than usual to v6. No ♂ brand.
Melanitis, Fab. The Evening Browns. (Plate 14).

23 (22). F in ♂ v1 ends mid dorsum and v 2 at tornus ; ♀ normal.
Cyllogenes, But. The Evening Browns. (Plate 14).

24 (22b). Venation very abnormal. F v12 runs to beyond origin v8, v11 runs into 12, vs 9 & 10 run through 12. H v5 from upper end cell, scv straight from origin, giving off 6 & 7.
Parantirrhœa, WM. The Travancore Evening Brown.

25 (6b). H with prediscoidal cell at base 8, formed by a vein from scv to v8. Palpi with appressed hairs. F cell very short, upper apex acute, lower dcv concave. H v3 from end cell, lower dcv concave.
Elymnias, Hub. The Palmflies. (Plates 14—15).

D1. Mandarinia.—The Mandarins. (Plate 11).

Above dark brown with a blue discal band upf ; below complete row submarginal ocelli. ♂ uph dark brand bases 5 & 6, entering cell and covered by a prominent tuft black hairs, springing from mid cell ; polished area about mid v1 unf and dorsum F bowed.
**regalis, Leech.* (45-50). The Mandarin. Shan States. VR.

D2. Mycalesis.—The Bushbrowns. (Plate 11).

All the species have in the ♂ a more or less well developed brand on uph about origin v7 set in a nacreous area and covered by an erectile tuft of hairs ; this is correlated to a similar brand along v1, unf also set in a nacreous area. Many species have additional brands, etc., which are referred to in the key. Seasonal variation is marked by obsolescence of ocelli below.

1a (8a). ♂ upf an elongated cavity along mid v1, covered by a hair pencil more or less well developed ; some of the veins swollen or distorted.

1 (2a). Below no straight discal line across wings, some ill-defined pale brown and lilacine markings. Above ♂ dark velvet brown, apex F prominently paler and a blind ocellus in 2 ; ♀ with a broad red discal band from ocellus to costa. ♂ upf yellow tuft below v1 : uph tuft white over small dark brand on large white area ; unf small dark brand on a broad white area : Hvs normal.
maianeas. Hew. (24-30). The Bandless Bushbrown. Mergui. V.R.

2*a* (1). Below a well defined discal band.

2b (7). ♂ above not blue glossed.

2 (3a). Above unmarked, Below outwardly paler lilacine in WSF, lilacine and yellow in DSF. ♂ uph brand white, tuft pale yellow ; unh no brand, upf brand and tuft black, prominent ; H v7 origin pushed back to before mid cell.
adamsoni Wat. (45-50) Watson's Bushbrown. Manipur N. Burma. R.

3a (2). Above not unmarked.

3b (5a). Upf pre-apical white band. Below as in No. 1.

3 (4). Uph in ♂ no large black discal patch.

α. Uph brand black, tuft pale yellow ; remaining brands, etc., as in No. 1, except there is a small black brand unf.
anaxias anaxias, Hew. (48-55). The Whitebar Bushbrown. S. India. NR.

β. Uph brand pale yellow.
**anaxias æmate, Fruh.* Sikkim.—Burma. NR.

γ. Upf prominent ocellus in 2.
anaxias radza, M. Andamans. R.

δ. Upf pre-apical band wider, inner edge nearly to cell.
anaxias manii, Doh. Nicobars. VR.

D2. Mycalesis.—The Bushbrowns. (Plate 11).—*contd.*

4 (3). ♂ uph prominent black patch between bases 5 & 7 ; H costa very arched, v6 pushed back as well as 7 and its basal half swollen ; remaining brands as before. Upf ocellus in 2 more or less apparent.

anaxioides, Mar. (52-62). The Large Whitebar Bushbrown. Karens—S. Burma. R.

52 (36). Upf no preapical white band, but always a prominent pupilled ocellus in 2 ; unf never an ocellus in 3. ♂ unf brand small, brown ; uph brand and tuft brown.

5 (6). H v3 from end cell. ♂ upf brand prominent.

a. Below discal line lilac. Upf usually an ocellus in 5. Uph no ocelli.

**francisca sanatana, M.* (48-55). The Lilacine Bush-brown. Kulu—Burma. NR.

β. Below discal line white. Upf prominent ocellus in 5. Uph often ocelli in 2 & 3.

francisca albofasciata, Tyt. Manipur above 6,000 feet. R.

6 (5). H v3 from before end cell. ♂ upf brand obsolete and tuft obscure ; H upper dcv swollen. Above paler, ocellus in 2 very large and always one in 5, none uph. Below pale brown, inwardly darker in DSF ; discal line white.

gotama charaka, M. (45-50). The Chinese Bushbrown. Assam—Burma. R.

7 (2b). ♂ above purple glossed, no pupilled ocelli ; ♀ pale brown, all ocelli show through and are obscurely pupilled ; below pale ochreous, discal lines dark brown. ♂ unh brand brown ; uph brand long, brown, tuft dark brown ; upf brand obsolete, tuft brown, obscure ; H origin v7 pushed back ; uph large black patch between bases 2-4 ; F dorsum bowed.

orseis nautilus, But. (48-52). The Purple Bushbrown. Nagas—Burma. VR.

8a (1a). Upf ♂ no brand and H veins normal.

8b (34) . F origin v10 at or near end cell.

8c (22a 32). H. origin v3 at or just beyond end cell.

8 (9a). F dcv 4-5 nearly straight. ♂ above dark brown, ocelli show through unpupilled ; ♀ pale brown, all ocelli show through, with complete pupils and rings ; below ochreous with 2 prominent fulvous bands. ♂ unf no brand ; uph no brand, only a cavity, tuft white ; H v6 swollen at base.

**fuscum, Fd.* (40-50). The Malayan Bushbrown. Tavoy—S. Burma. R.

9a (8). F. dcv 4-5 concave and angled.

9b (20a). Uph normally only an ocellus in 2, very rarely one in 5. Uph never more than an ocellus in 2.

9c (19). H vs 6 & 7 well separated at base ; lower dcv at an angle to v3. ♂ only normal brands and tuft uph pale yellow.

9d (11a. 17-18). Unf small brand placed centrally under origin v2.

9 (10). ♂ uph brand black ; unf black, very small. Uph ocellus not ringed ; unh ocellus in 3 shifted out of line ; unf WSF curved series ocelli in 2-5. F DSF termen straight or slightly concave.

a. Smaller. Upf usually unmarked in WSF.

perseus typhlus, Fruh. (38-50). The Common Bushbrown. Ceylon—Himalayas and Bengal. VC.

β. Upf always a pupilled ocellus in 2.

perseus blasius, F. (45-55). Kangra—Burma. VC.

10 (9). ♂ uph brand salmon pink or brown ; unf brand small, brown. Upf ocellus situated in a more or less pale area, outwardly and inwardly defined by a narrow dark line ; ocellus ring diffused into this area and never narrow, of uniform width or sharply defined.

a. WSF often very dark below and with small ocelli. DSF upf pale area often very extensive.

* *mineus polydecta, Cr.* (40-48). The Dark-brand Bushbrown. Ceylon—Bengal. VC.

D2. Mycalesis.—The Bushbrowns. (Plate 11).—*contd.*

β. Larger.

mineus mineus, L. (45-50). Kulu—Burma. C.

γ. Darker and ocelli below larger.

mineus nicobarica, M. Nicobars. C.

11a (9d 17-18). Unf brand extends from under origin v2 to at least under origin v 3 and often much further.

11b (13a). Unf WSF brand to beyond outer edge of discal band; DSF to under origin v3 or 4, but, if not through discal band, the latter is bent outwards between v1 & 2 and sharply angled at v1.

11 (12). Uph brand brown or pale yellow; unf DSF brand pale yellow or brown; WSF inwardly brown and outwardly pale yellow. Upf pale area as in No. 9; unf discal band always angled at v1 in DSF and up to v1 in WSF, being outwardly curved before reaching it.

igilia, Fruh. (40-48). The Small Long-brand Bushbrown. Coorg, Mysore. NR.

12 (11). Uph brand pale brown; unf pale brown to brown.

a. F DSF apex sharp pointed and termen straight; WSF more rounded. WSF upf ocellus large, well defined.

visalav isala, M. (45-55). The Long-brand Bushbrown. S. India, Pachmarhi. Kumaon—Assam. C.

β. F apex more rounded.

visala neovisala, Fruh. Burma. R.

γ. F. apex rounded. Much darker.

visala andamana, M. Andamans. C.

13a (11b). Unf brand never through the discal band, though may be up to it; discal band not angled at v1.

13 (14a). Uph brand black. Upf WSF ocellus with rather broad and prominent yellow ring; unf discal band to costa; apex F very rounded. DSF always more or less ocellated and with a wavy postdiscal line always more or less apparent.

perseoides, M. (45-50). The Burmese Bushbrown. Katha—S. Burma. C.

14a (13). Uph brand pale yellow.

14 (15a). Above prominent pale sub-marginal line followed by 2 dark lines; inner half cilia pale, outer half dark. Upf ocellus with a narrow well defined, though often obscure, ring; unf always an ocellus in 1. Below WSF very black.

subdita, M. (43-50). The Tamil Bushbrown. Ceylon, Nilgiris, Madras, Orissa. NR.

15a (14). Above pale sub-marginal line obscure as usual.

15 (16). F apex very rounded; H termen very scalloped and almost caudate at v4; ♀ termen chequered. Below ♂ DSF always ocellated; ♀ very variegated.

mercea, Evans. (40-48). The Pachmarhi Bushbrown. Pachmarhi. NR.

16 (15). F apex more pointed and termen even.

a. Occurs in 3 forms, WSF, intermediate and DSF.

khasia orcha, Evans. (42-55). The Pale-brand Bushbrown. Palnis, Coorg, Nilgiris. C.

β. Occurs in 2 forms only, WSF and DSF.

khasia khasia, Evans. Assam—Burma. C.

17 (9d. 10a. 18). Uph and unf brand silvery white, hard to see on the nacreous area. Above dark ferruginous, ocellus upf fulvous ringed and usually an ocellus in 5 and in 2 uph; below ochreous brown with broad yellow discal band.

rama, M. (48-58). The Cingalese Bushbrown. Ceylon. R.

18 (9d. 11a. 17). Unf no brand; uph brand dark brown, tuft reduced. Below pale brown, discal band pale yellow. Wings very rounded.

evansii, Tyt. (40-50). Tytler's Bushbrown. Assam, Manipur. R.

D2. Mycalesis.—The Bushbrowns. (Plate 11).—*contd.*

19 (9c). H vs 6 & 7 approximate at origin, lower dcv in line with v3. Below DSF dull ochreous, always more or less ocellated. ♂ unf no brand; uph no brand in usual place, but tuft present, white; uph white brand below origin v6, covered by recumbent tuft black hairs rising beyond mid cell; H v1 swollen and covered by recumbent tuft black hairs.

mystes, DeN. (45-50). The Many-tufted Bushbrown. Manipur—Karens. R.

20a (9b). Uph normally 3 ocelli, may be 2 or 4. Above very dark ferruginous brown. ♂ uph brand black, tuft brown. F vs 5 & 6 well separated at origin.

20 (21). Upf large ocellus in 2 and all ocelli above prominently fulvous ringed, except ocellus in 5 upf. Unf no brand and tuft uph very inconspicuous.

adolphei, Guer. (50-55). The Red-eye Bushbrown. Coorg, Nilgiris. NR.

21 (20). Upf large ocellus in 2 on a wide fulvous area, ocellus in 5 minute or absent; uph ocelli fulvous ringed or on a fulvous area. H termen caudate at v4. Unf small black brand.

**oculus, Mar.* (45-60). The Red-disc Bushbrown. Travancore, Palnis. C.

22a (8c. 32). H origin v3 before end cell.

22b (28a. 31). Pupilled ocelli present in 2 and 5 upf, latter rarely absent, and in 2 uph.

22 (23a). Below dark discal line; apex F produced. Above ochreous brown, ocellus in 2 upf enormous, with broad yellow ring. Below pale. Unf no brand but prominent square white patch in nacreous area; uph brand golden brown, tuft bright yellow.

**mnasicles perna, Fruh.* (60-70). The Cyclops Bushbrown. Shan States S. Burma. R.

23a (22). Below pale yellowish discal line.

23 (24a). Below ground colour uniform, not mottled. Cilia white. Above prominent ocelli in 2 and 5 upf and 2 upf. Unh brand small, pale yellow; uph brand pale yellow, tuft pale brown; uph long erect dense hairs along basal part v1.

suavolens, WM. (60-70). Wood Mason's Bushbrown. Sikkim—N. Burma. R.

24a (23). Below basal area mottled.

24 (25a). Cilia white. Above ocelli small; those in 2 F and H equal and that in 5 H minute or absent. Unh in addition to ocellus in 2 there are 2 apical ocelli; unh ocellus in 3 absent. Unf brand minute, black; uph brand small black, tuft brown.

α. Upf white discal band obscure.

mestra vetus, Fr (60-70). The White-edged Bushbrown. Sikkim—Bhutan. R.

β. Upf white discal band prominent.

**mestra mestra, Hew.* Assam. R.

25a (24). Cilia pale brown. Above ocelli larger; those in 5 F and 2 H equal, that in 2 F much larger. Below ocelli complete and those on F in line.

25 (26a). Uph in addition to ocellus in 2 always one in 3, usually in 2 and more rarely in 1. Upf ocellus in 2 enormous. Unf no brand; uph brand black and tuft brown.

heri, M. (60-70). Moore's Bushbrown. Kumaon—Bhutan. R.

26a (25). Uph rarely more than the ocellus in 2; if so very small.

26 (27). Below outer area before discal line nearly black, mottling confined to base. Unf brand small, salmon; uph brand salmon, tuft yellow brown.

misenus, DeN. (60-65). DeNiceville's Bushbrown. Sikkim—Assam. R.

27 (26). Below brown and mottled up to discal line. Upf ocellus in 2 much larger than rest. Brands and tuft black.

nicotia, Hew. (55-60). The Bright-eye Bushbrown. Mussoorie—Karens. NR.

28a (22b 31). Above ocelli blind. Below mottled; pale yellow or white discal line. Brands black and tuft brown.

D2. Mycalesis.—The Bushbrowns. (Plate 11).—*contd.*

28 (29a). Above white discal line clearly defined.

malsara, M. (40-50). The White-line Bushbrown. Sikkim—Rangoon. C.

29a (28). Above white discal line not visible.

29 (30). Upf nearly always subequal ocelli in 3 and 5 as well as the usual one in 2 ; rarely ocellus in 1. Uph always an ocellus in 2 and 3, even when the ocelli upf are reduced to one in 2. Cilia brown.

a. Wings rounded.

mamerta mamerta, Cr. (45-50). The Blind-eye Bushbrown. Assam—Shan States. NR.

β. Wings elongated. Termen H very scalloped.

mamerta annamitica, Fruh. Karens—S. Burma. R.

30 (29). Upf normally no ocellus in 3, if present, smaller than ocellus in 5. Uph there may be ocelli in 2 & 3, but always absent, if ocellus in 5 upf is absent.

a. Cilia white, prominently chequered at ends veins.

lepcha davisonii, M. (45-50). The Lepcha Bushbrown. Palnis, Animalais. NR.

β. Cilia brown. Below discal line wide, outwardly ill-defined.

lepcha bethami, M. Pachmarhi, Orissa. R.

γ. Cilia brown. Below discal line narrow, threadlike and obsolete towards costa unf.

lepcha lepcha, M. Kulu—Kumaon. NR.

δ. Cilia white, not chequered. Very dark above and below.

lepcha kohimensis, Tyt. Assam—Karens. NR.

31 (22b 28a). Above unmarked, prominent double ante-terminal line. Below uniform, discal line lilacine ; unh ocelli in 2 and 3 larger than rest. Wings very rounded. Unf brand absent or minute, dark ; uph brand black, tuft brown, inconspicuous ; H bases vs 2, 3 and 4 slightly swollen and covered with scattered erect hairs.

malsarida, But. (45-50). The Plain Bushbrown. Assam. R.

32 (8c, 22a). H origin v3 far beyond end cell. Unf no brand ; uph brand black, tuft pale brown. Above dark brown, ocellus in 2 upf set obliquely at lower edge of pale area, minute ocellus in 5 usually present ; these ocelli pupilled ; uph no ocelli. Below not mottled.

a. Upf pale area fulvous and fulvous patch in cell. Below fulvous.

patnia patnia, M. (40-45). The Gladeye Bushbrown. Ceylon. C.

β. Upf pale area white. Below rather pale brown.

**patnia junonia, But.* S. India. NR.

33 (8b). F origin v10 well beyond end cell. ♂ unf small dark brand : uph brand pale yellow, tuft pale yellow ; uph small dark brand above origin v6 ; H v1 distorted towards v2 resulting in a fold in the wing, over which there is a recumbent tuft of brown hairs. Above brick red ; upf blind ocellus in 2 ; below very dark, not mottled.

oroatis surkha, Mar. (50-55). The Road Bushbrown. Dawnas—S. Burma. VR.

D3. Lethe.—The Treebrowns. (Plates 11 & 12).

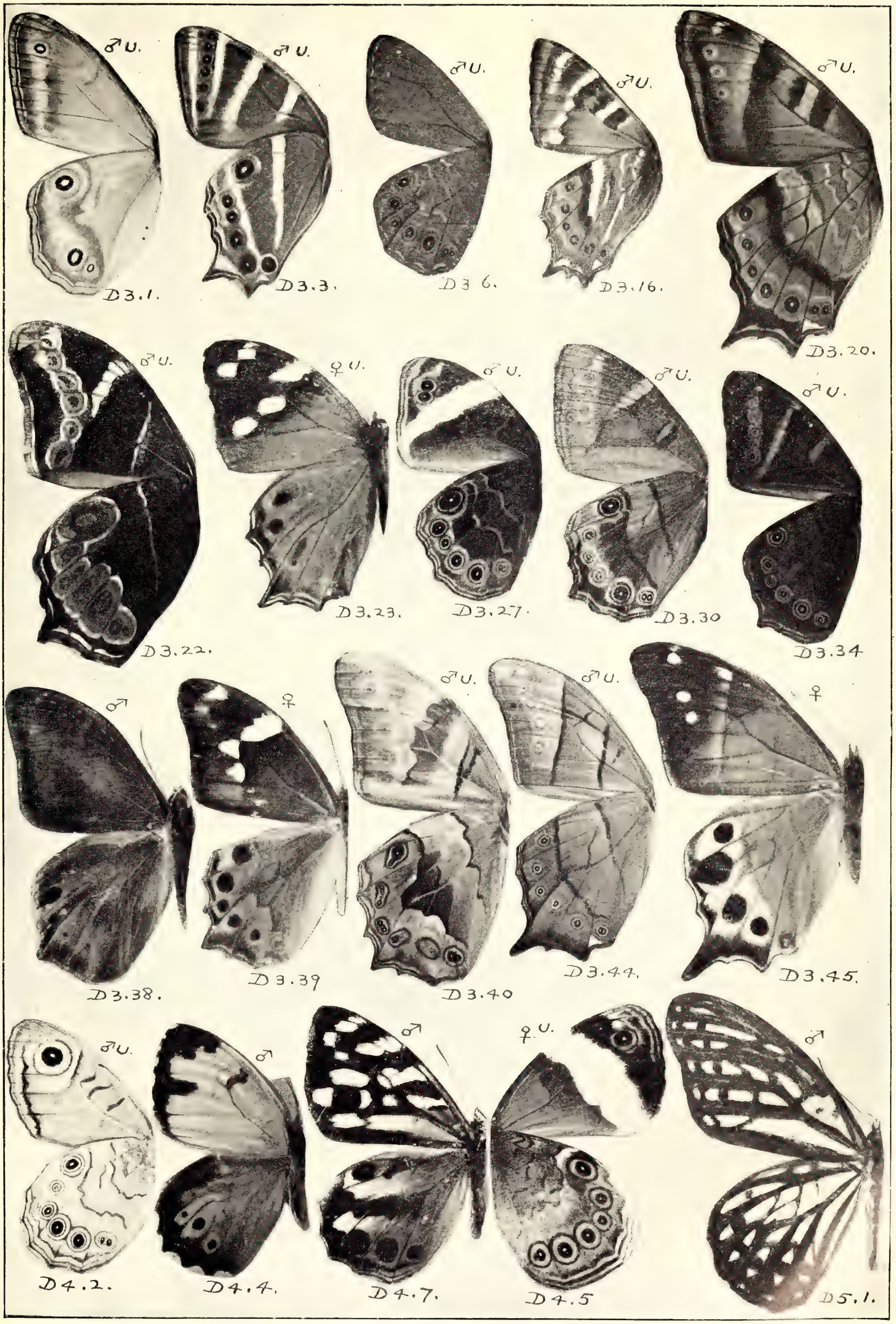
1a (47a). Unh never with an ocellus in 7. H v8 about ½ length v7 .

1 (2a). Unh only a single apical and 2 tornal ocelli ; unf a single apical ocellus and cell unmarked. Above fulvous. F upper apex cell acute, dcv evenly concave ; v10 ends after origin v8. H v3 from end cell. No ♂ brand.

**gemina gafuri, Tyt.* (60-70). Tytler's Treebrown. Nagas. VR.

2a (1). Unh complete row 6 ocelli.

2b (5a). Unh central 4 ocelli in a straight line, inwardly lying against a broad white band. F upper apex cell slightly acute ; dcv concave and angled below


♂ U.
D3.1.
♂ U.
D3.3.
♂ U.
D3 6.
♂ U.
D3.16.
♂ U.
D3.20.
♂ U.
D3.22.
♀ U.
D3.23.
♂ U.
D3.27.
♂ U.
D3.30
♂ U.
D3.34
♂
D3.38.
♀
D3.39
♂ U.
D3.40
♂ U.
D3.44.
♀
D3.45.
♂ U.
D4.2.
♂
D4.4.
♂
D4.7.
♀ U.
D4.5
♂
D5.1.

D. **Satyridae.** 3. *Lethe*: 4. *Pararge*: 5. *Orinoma*.

D3. Lethe.—The Treebrowns. (Plates 11 & 12).—*contd.*

v5. F end v10 beyond origin v8. ♂ uph dark brand in 7 from base v8 to origin v7, entering 6 and cell.

2 (3a). Unf pale bar end cell. Unh v1 pale and a pale basal marking from costa across cell.

a. Unf discal ocelli obsolete or obscure. Smaller and paler.

baladeva aisa, Fruh. (55-65.) The Treble Silverstripe. Kumaon. R.

β. Unf discal ocelli prominent. Larger and darker.

baladeva baladeva, M. (67-70). Sikkim. R.

3a (2). These markings absent.

3 (4). Below dark brown. Unf discal ocelli and pale line beyond prominent.

**ramadeva, DeN.* (60-70). The Single Silverstripe. Sikkim. VR.

4 (3). Below ochreous. Unf discal ocelli and pale line beyond obsolete or nearly so.

andersoni, Atk. (60-70). Anderson's Silverstripe. Bhamo. VR.

5a (2b). Unh ocelli more or less on an arc and not inwardly bordered by a white band.

5b (23a). Unh markings in cell consist of more than one band.

5c (20a). H origin v3 before end cell.

5d (16a). H not excavated at tornus beyond v2, termen faintly caudate at v4 or more usually rounded.

5e (14a). Unh basal area marked with narrow waved lilacine or white lines. No ♂ brand.

5 (6a). Uph dark spots outwardly white bordered. ♀ mostly white.

visrava, M. (50-55). The White-edged Woodbrown. Sikkim—Bhutan. R.

6a (5). Uph no white.

6 (7a). Unh ocelli in 1-4 in a straight line pointing to below end v6; discal band much bowed out in middle. ♂ unf no traces of discal band; ♀ the faint discal band highly convex and ends half way along v2.

**siderea, Mar.* (48-55). The Scarce Woodbrown. Sikkim—N. Burma. R.

7a (6). Unh ocelli in 1-4 on a curve pointing to above end v6. Unf always traces of a discal band.

7 (8a). Unh apical ocellus always conspicuously larger than ocelli in 3-5. Unf markings white or silvery lilac.

a. Uph no black spots; unf white markings reduced.

sidonis vaivarta, Doh. (45-60). The Common Woodbrown. Kulu—Bhutan. NR.

β. Uph black spots always traceable.

sidonis sidonis, Hew. (45-60). Kumaon—N. Burma. C.

8a (7). Unh ocelli subequal. Unf discal band, if present, yellowish. Above bronzy.

8 (9a). Unh yellow rings of all ocelli absent. Unf prominent pale bar in cell and discal band.

maitrya, DeN. (45-55). The Barred Woodbrown. Simla—Sikkim. R.

9a (8). Unh yellow rings of at least apical and 2 tornal ocelli present.

9a (11a)1 Unh 4 apical ocelli in a straight line. Unf prominent pale discal band and bar in cell. 9 (10). Uph prominent black spots.

nicevillei, Evans. (50-55). The Straight-eyed Woodbrown. Garhwal. Bhutan R.

10 (9). As last, but uph no black spots. Unf whitish band costa to tornus. Unh ocelli small, those in 3-5 blurred and prominent ferruginous discal band.

irma, Evans. (55). Bailey's Woodbrown. Gangtok, Sikkim. VR.

11a (9a). Unh 4 apical ocelli on a curve. Unf no pale bar in cell.

11 (12a). Unh ocellus in 3 or in 3 and 4 blurred. Unf only traces of a discal band and apical spots. Uph complete series dark spots. H evenly rounded.

nicetella, DeN. (45-50). The Small Woodbrown. Sikkim. R.

D3. Lethe.—The Treebrowns. (Plate 11 & 12).—*contd.*

12a (11). Unh all ocelli clear. Uph ocellus in 2 usually absent. H angled or faintly caudate at v4.

12 (13). Unh discal silver line highly dislocated, in 2 drawn up to base and highly zigzagged in 1. ♂ unf only traces of discal band; ♂ ♀ discal band at an angle of 45 to costa. Unh in ♀ area between discal band and ocelli yellow.

kanjupkhula, Tyt. (50-60). The Manipur Woodbrown. Manipur. R.

13 (12). Unh discal silver line more regular, crosses 2 at origin v3 and only waved in 1; ♂ ♀ area beyond discal band yellow. Unf discal band at right angles to costa.

nicetas, Hew. (48-55). The Yellow Woodbrown. Kulu—Manipur. NR.

14a (5e). Unh no pale markings; ferruginous bands on a rather pale ochreous brown ground, basal markings in cell very obscure, but traceable. ♂ upf broken brand from mid v1 to base v4.

14 (15). Unf pre-apical white spots from 3 or 4 to costa, appearing on upf in ♀.

tristigmata, El. (55-60). The Spotted Mystic. Sikkim. R.

15 (14). Unf preapical white spots, from 6 to costa.

ocellata lyncus, DeN. (55-60). The Dismal Mystic. Sikkim. Manipur. VR.

16a (5d). H sharply excavated at tornus beyond v2 and strongly caudate at v4. Unh with an inverted Y-shaped dark band from costa to lower end cell, beyond which is a straight broad white or yellow band. ♂ brand upf usually obscure or obsolete.

16 (17-18). Unh area behind dark band end cell ferruginous, bearing a single narrow irregular line from costa through mid cell. ♂ upf prominent broad brand.

kabrua, Tyt. (55-60). The Manipur Goldenfork. Manipur. R.

17 (16,-18,-19). Unh area behind dark line end cell dark brown, bearing 2 narrow irregular lines from costa across cell.

a. Unf 2 apical ocelli. Markings narrower and darker.

jalaurida jalaurida, DeN. (50-55). The Small Silverfork. Kulu—Kumaon. R.

β. Unf 1 apical ocellus. H more produced at tornus; discal line straighter at lower end.

**jalaurida elwesi, M.* (50-55). Sikkim. NR.

18 (16,-17,-19). Unh area behind dark band end cell brown, bearing a straight pale broad band from costa across cell and a very obscure basal band. Unf no apical ocelli.

moelleri, EL. (50-55). Moeller's Silverfork. Sikkim. NR.

19 (16,-18). Unh area on either side dark band end cell yellow, base ferruginous brown. Above with fulvous markings.

atkinsonia, Hew. (48-55). The Small Goldenfork. Sikkim-Bhutan. R.

20a (5c). H origin v3 from end cell; caudate at v4 and excavate beyond v2. Unh an inverted Y-shaped dark band at end cell as in last group and a pale broad dark bar near base. ♂ upf broad brand from mid v1 to base v4.

20 (21a). Unh dark discal band does not widen towards costa. Pale areas below yellow.

a. Unh outer edge dark discal band regular.

goalpara narkanda, Fruh. (65-75). The Large Goldenfork. Simla. R.

β. Unh outer edge dark discal band very irregular.

goalpara goalpara, M. (65-80). Sikkim—Assam. NR.

21a (20). Unh dark discal band widens towards costa. Unh pale areas lilacine, becoming more or less yellow in ♀.

20 (21). Unh inner edge discal band straight between vs 6-4. ♂ upf uniform dark brown.

**sura, Db.* (65-85). The Lilacfork. Sikkim—N. Burma. C.

D3. Lethe—Treebrowns. (Plates 11 & 12).—*contd.*

22 (21). Unh inner edge discal band angled between vs 6-4. ♂ upf outwardly paler; uph outwardly greyish and upper dark spots usually absent.

a. Pale outer area broad.

dura gammiei, M. (70-85). The Scarce Lilacfork. Sikkim—Bhutan. VR.

β. Darker. Pale outer area narrow. Uph spots very small.

dura dura, Mar. (70-85). Karen Hills. VR.

23a (5b). Unh single band across mid cell. F upper apex cell right angled and upper dcv more or less angled.

23b (28a). F cilia chequered, dark at ends veins and whitish between. ♀ always with white band. H v3 from end cell; caudate. Unh ocelli more or less disintegrated.

23c (27). ♂ upf no white band and no brand.

23 (24a). Unh no discal band, all ocelli very large and much disintegrated. Unf single pale band across cell.

a. Uph black spots prominent. Below very dark.

europa ragalva, Fruh. (65-75). The Bamboo Treebrown. S. India. NR.

β. Below paler. Very similar.

**europa niladana, Fruh.* (65-75). Dun—Burma. C.

γ. Larger, very dark. Unf ♀ white discal band straighter at costa.

europa nudgara, Fruh. (70-80). Andamans. NR.

δ. ♀ above band yellow.

europa tamuna, Doh. (70). Nicobars. VR.

24a (23). Unh with discal band. Unf broad dark inner bar in cell continued into 1 and there is a narrow irregular outer one separated by a pale area.

24b (26). Unh ocelli in 3, 4 and sometimes 5 elongated and distorted.

24 (25). Unh apical ocellus conspicuously larger than ocellus in 2.

a. ♂ upf whitish outer spot in 2; ♀ white band in 3 well separated spots.

**rohria nilgiriensis, Guer.* (58-65). The Common Treebrown. Ceylon. S. India-Pachmarhi. C.

β. ♂ upf no pale spot in 2 and ♀ with white band continuous.

rohria dyrta, Fd. Kashmir—Kumaon. C.

γ. As last, but larger and darker usually. Uph black spots larger. Unf discal band more irregular on inner edge and continued to v1 in ♀.

rohria rohria, F. (60-70). Sikkim—Burma. C.

25 (24). Unh apical ocellus not larger than rest. ♂ upf no white spots.

a. ♀ upf band broad and irregular, spot in 3 shifted in, so that its outer edge is in line with spot in 2. ♂ uph small spots in 3, 4 and 5.

drypetis drypetis, Hew. (65-70). The Tamil Treebrown. Ceylon. NR.

β. ♀ upf band narrow and regular, spot in 2 long and narrow, no spot in 1. ♂ uph spot in 5 large and prominent.

drypetis todara M. S. India—Orissa. NR.

26 (24b). Unh ocelli in 3-5 rounded, only slightly disintegrated.

daretis, Hew. (50-60). The Ceylon Treebrown. Ceylon. NR.

27 (23c). ♂ ♀ with white band upf. Unh ocelli rounded and hardly disintegrated. Unf single pale line in cell, continued to v1. ♂ uph a dark brand base 6, extending into cell, 7 and 5.

a. Smaller, paler, markings smaller. Unf usually only 2 apical ocelli.

confusa confusa, Aur. (50-55). The Banded Treebrown. Murree—Sikkim. C.

β. Unf nearly always 3 apical ocelli.

confusa gambara, Fruh. (52-65). Assam—Burma. C.

28a (23b). F cilia uniform.

28 (29a). ♂ ♀ with broad even white band ending above v1 on termen, no white apical spots or ocelli. Unh ocelli practically perfect. Unf single obscure pale bar in cell. H v3 from end cell; faintly caudate. ♂ brand as in last.

D3. Lethe.—Treebrowns. (Plates 11 & 12).—*contd.*

α. Upf band narrow. Uph only an ocellus in 2.

verma verma, Koll. (55-60). The Straight-banded Treebrown. Kashmir—Kumaon. C.

β. Band wider. WSF larger. Uph always an ocellus in 2 and 3.

verma sintica, Fruh. Sikkim—N. Burma. C.

γ. Smaller and band narrow, rather yellowish. Unh ocelli small.

**verma stenopa, Fruh.* (50-55). Shan States—S. Burma C..

29a (28). ♂ upf never with a white band.

29b (31a). Unf no or very faint marking in cell (except ♀ of No. 29). Upf ocelli and sub-marginal dark line apparent; uph complete series spots. Unh ocelli perfect; apical very large and shifted in. H v3 from end cell. No male brand.

29 (30). ♂ above no band or white spots; ♀ very broad white band. H rounded, costa and termen highly convex.

naga, Doh. (70-80). The Naga Treebrown. Manipur, Nagas. R.

30 (29). ♂ upf narrow yellow band; ♀ white band. Unh no discal band; single pale band through end cell.

margaritæ, El. (85-95). The Bhutan Treebrown. Bhutan. VR.

31a (29b). Unf always prominent mark in cell.

31b (39a). Unf 2 (3 in No 32) dark markings in cell, of which the inner, if any, is continued into 1 or there may be a dark marking in 1 between the 2 cell markings.

31c (35a). H v3 from end cell; caudate.

31d (34). Unh tornal ocellus bipupilled as usual.

31e (33). Unf outer dark line in cell straight; inner line broad but single. Unh all ocelli perfect. No ♂ brand.

31 (32). ♂ unf discal line curved in at upper end and broadly pale there. ♀ broad white discal band.

α. ♀ upf discal band of even width and curved down at tornus.

insana insana, Koll. (55-60). The Common Forester. Chamba—Kumaon. R.

β. Below washed metallic violet. ♀ upf band narrower and straighter.

**insana dinarbas, Hew.* Kumaon—Assam. NR.

32 (31). ♂ unf discal line straight and outwardly evenly and narrowly pale throughout. ♀ a very narrow whitish discal band unf, appearing as a narrow pale brown band above.

brisanda, DeN. (55-60). The Dark Forester. Bhutan—Assam. R.

33 (31e). Unf outer dark mark in cell concave and well separated from inner mark, which is double. ♀ above no pale band, but dark band from below shows through and area beyond is paler, 2 pale apical dots. ♂ upf large triangular brand from mid dorsum to vs 4 and 5. Unh pupils of ocelli 3-5 dimmed but not disintegrated.

α. Unh basal band straight.

serbonis serbonis, Hew. (60-70). The Brown Forester. Sikkim. R.

β. Unh basal band broken in at v6.

serbonis naganum, Tyt. (70-75). Manipur, Nagas. NR.

34 (31d). Unh tornal ocellus single, ocelli in 3-5 slightly disintegrated. ♂ below very dark, washed violet; ♀ paler and outwardly yellowish. ♀ upf white band with detached spot in 1; uph with pale yellow areas across the black spots. ♂ upf long brand in outer part of 1, showing as a raised patch below and crossed by a recumbent tuft of black hairs.

dynsate, Hew. (55-60). The Ceylon Forester. Ceylon. VR.

34b (31c). H v3, from before end cell, somewhat caudate. ♂ uph prominent brand along basal ½ v3 covered by recumbent tuft black hairs. Unh all ocelli perfect. Unf discal band ends on dorsum well before tornus.

D3. Lethe.—Treebrowns. (**Plates 11 & 12.**)—*contd.*

35 (36a). Unf area between dark bars in cell pale, inner bar broad. ♂ above outwardly blue shading to purple. ♀ dark brown; unf narrow yellow band just showing above. ♂ upf dark brand about middle v1.

**scanda, M.* (58-65). The Blue Forester. Silkim—Assam. R.

36 (37a). Unf discal dark line crosses v2 much nearer its end than its origin; unh basal band straight. ♂ upf unmarked; ♀ unf narrow white band, which shows above as a prominent pale brown band, as well as 2 yellowish apical dots. ♂ upf brands along each vein from 1-6 decreasing in width.

latiaris, Hew. (55-65). The Pale Forester. Sikkim—Karens. R.

37a (36). Unf discal dark line crosses v2 beyond its middle.

37 (38). Unh basal dark line very irregular, broken at mv and v7. ♂ upf unmarked; ♀ with 3 yellow outer spots in 3, 4 and 7 and discal in 2 and 3. ♂ uph brand in basal ½ of 5 and 6; upf brand along middle of v1 and dorsum bowed.

a. Unf cell bars posteriorly convergent.

gulnihal gulnihal, DeN. (58-64). The Dull Forester. Bhutan—N. Burma. VR.

β. Unf cell bars parallel. Much darker and ♂ below more ochreous. ♀ spots above more obscure.

gulnihal peguana, M. Karen Hills. R.

38 (37). Unh basal dark line regular. ♂ upf marked as ♀ of last, discal spots often absent. ♀ with a row of small discal white spots from 1-6 and uph spots ringed dark orange. ♂ uph brand in basal ½ of 4-6; upf brand along v1, dorsum not bowed.

bhairava, M. (65-75). Sikkim—Assam. NR.

39a (31b). Unh 2 dark marks in cell of which outer is continued to v1, inner one sometimes absent (No. 40 aberrant). H v3 from end cell.

39b (44a). Unh ocelli mostly disintegrated. H more or less caudate.

39c (43). Upf ♂ unmarked; ♀ with a prominent white band with lower 2 or 3 spots detached and 1 or 2 apical spots.

39 (40a). Unh apical ocellus disintegranted. ♂ uph outwardly red; ♀ bright brick red. ♀ upf always white spot in 1 and very faint discal line. Unh basal dark line straight. ♂ uph brand towards base 2 covered by tuft hairs; uph brand from dorsum to v3.

**minerva tritogeneia, Fruh.* (63-70). The Branded Red Forester. Chin Hills—S. Burma. NR.

40a (39). Unh apical ocellus perfect or very nearly so. ♂ uph no brand. ♀ upf very rarely spot in 1.

40 (41a). Unh basal dark line straight, unbroken. ♂ upf obscure brand dorsum to v4. ♀ uph outer area more or less red. ♀ rather dusky red, discal line prominent upf.

a. ♂ uph outer area paler. ♀ lighter. Below much paler.

mekara mekara, M. (65-75). The Common Red Forester. Sikkim. C.

β. Darker especially in WSF.

**mekara zuchara, Fruh.* Assam—Burma. C.

41a (40). Unh basal line irregular and more or less broken.

41 (42). Unh discal dark line much bent out in middle, in 2-4 separated from the ocelli by only the width of the latter. ♂ uph red marginal area obscure or absent. ♀ dusky red above. ♂ brand as in No. 39.

a. ♀ above outwardly paler. ♀ paler both sides.

chandica chandica, M. (65-75). The Angled Red Forester. Sikkim. C.

β. Much darker.

**chandica flanona Fruh.* Assam—Burma. NR.

42 (41). Unh discal dark line not so much bent out in middle, in 2-4 far from ocelli. ♂ brand obsolete. ♂ uph outer area bright red with prominent black spots; ♀ mostly bright red. Below F margin and H tornal area yellow.

D7. Lethe—Treebrowns. (Plates 11 & 12)—*contd.*

distans, But. (70-80). The Scarce Red Forester. Sikkim—Karens. VR.

43 (39c). ♂ upf unmarked; uph outer area pale brown with black spots. Unh basal area uniform pale brown, outer area about ocelli whitish; basal line straight, discal line as in No. 40. ♀ unknown.

satyvati, DeN. (65-75). The Pallid Forester. Assam. VR.

44a (39b). Unh ocelli perfect; strongly caudate. Below dark lines very straight. ♂ obscure or nearly obsolete brand upf, from dorsum to 4 or 5.

44 (45a). Below area beyond discal line prominently paler and outer edge basal dark line prominently edged whitish. Upf discal line showing (whitish in ♀) and beyond paler. Uph black spots prominent and ringed fulvous.

vindhya, Fd. (65-70). The Black Forester. Sikkim—Burma. NR.

45a (44). Below uniform. Upf with small pale spots in 3, 4 and 6 and in ♀ spots beyond cell; discal line from below faintly showing in ♂, prominent in ♀.

45 (46). Uph spot in 4 and unh ocellus in 4 on even curve with rest. Uph spots yellow ringed.

**kansa, M.* (65-75). The Bamboo Forester. Kumaon—Burma. C.

46 (45). Uph spot in 4 absent and unh ocellus in 4 out of line with rest, nearer margin. Uph ocelli placed on a red area in ♂ and on an orange area in ♀, where basal area F and H is dark dusky red, apical and terminal area F dark brown.

**sinorix, Hew.* (70-78). The Tailed Red Forester. Sikkim—Karens. R.

47a (1a) Unh with an ocellus in 7. Cilia chequered. ♂ brand upf mid dorsum to 4, obscure or prominent.

47b (51a). Upf and unf a number of large yellow or whitish spots, always 2 spots in 3.

47c (49a). Always 2 pale spots in 2 upf; v1, mv and bases vs 2 and 3 yellow.

47 (48). Upf spot beyond cell in 5 rarely present and, if so, in line with spot in 4, not well behind it. Unf costal bar beyond cell oblique.

a. Smaller, darker and markings smaller. Upf pale bar before end cell not continued across at full width.

pulaha pulaha, M. (60-70). The Veined Labyrinth. Chamba—Sikkim. NR.

β. Larger and paler. Upf pale bar before end cell continued across cell at full width.

**pulaha pulahoides, M.* Assam—Karens. R.

48 (47). Upf beyond cell a spot in 5 in continuation of the 2 costal spots and unf pale costal bar continued to v4 at right angles to the costa; pale markings in inner two-thirds of cell nearly obsolete. Unh darker, basal markings very obscure, ocelli larger. Above darker and spots deeper yellow. F apex less produced. H costa and v8 straight, not convex.

pulahina, Evans. (60-70). The Dusky Labyrinth. Sikkim—Manipur. R.

49a (47c). Upf and unf only one pale spot in 2; no veins yellow.

49 (50). Unh no ocellus in 1a. Upf pale bars in cell obscure. Unf central pale bar in cell highly angled and behind it a similar angled bar. DSF uph outwardly yellow; WSF brown except for yellow ocelli rings.

armandii, Ob. (75-85). The Chinese Labyrinth. Assam. R.

50 (49). Unh with an ocellus in 1a. Upf 2 pale bars in cell prominent. Unf central pale bar in cell oblique but straight, behind it only a pale detached bar against upper edge cell.

**bhadra, M.* (80-100). The Tailed Labyrinth. Sikkim—Karens. NR.

51a (47b). Upf no pale spots or markings, except ocelli rings.

51 (52). Below discal band prominently pale edged; ocelli F large and prominently pupilled, discal band outwardly curved at lower end. ♀ with black spots F very prominent and edged dull yellow outwardly.

****muirheadi bhima, Mar.*** (70-80). The Black-spotted Labyrinth. N. Burma —Karens. R.

D3. Lethe—Treebrowns. (Plates 11 & 12)—*contd.*

52 (51). Below discal band very obscurely white edged. Ocelli F small and rather obscure, ocellus in 2 not larger than rest, discal band straight. ♀ rather as last, but black spots not so prominent.

a. Smaller and much paler.

yama yama, M. (70-85). The Dusky Labyrinth. Kulu—Sikkim. R.

β. Larger, darker, and markings below much richer.

**yama yamoides, M.* (75-95). Assam—N. Burma. R.

D4. Parage.—The Walls. (Plate 12).

1a (4a). Upf prominent pupilled ocellus. F upper apex cell highly acute ; mv much swollen. H v3 from after end cell. Above dark brown, usually with a fulvous area upf. Antennæ club spatulate.

1 (2a). Unh discal line not broken in at v4. ♂ upf broad black brand from mid dorsum to base v4.

menava, M. (50-60). The Dark Wall. Baluchistan—Chitral—Kashmir. C.

2a (1). Unh discal line broken in at v2.

2 (3). Unh discal line evenly curved from costa to v5. ♂ upf narrow black brand as in last.

**schakra, Koll.* (55-60.) The Common Wall. Chitral—Kumaon. C.

3 (2). Unh discal line broken in between vs 6 and 7. No ♂ brand.

mœrula, Fd. (55-60). The Scarce Wall. Chitral—Kumaon. R.

4a (1a). Upf no pupilled ocelli. No ♂ brand. F upper apex cell right angled. H v3 from end cell. Antennæ club gradual.

4b (6a). Above veins concolorous with ground. Unf single pre-apical ocellus in 5.

4 (5). Above yellow ; unf 2 dark lines in cell. F mv much swollen.

**eversmanni cashmirensis, M.* (55-60). The Yellow Wall. Chitral—Kashmir. R.

5 (4). Above dark brown with broad white band F and 2 apical dots ; costa H white. Unf cell unmarked. F mv hardly swollen.

**masoni, El.* (60-65). The Chumbi Wall. Sikkim—Bhutan. NR.

6a (4b). Above veins black. Unf pupilled ocelli in 2 and 5 and 2 transverse bars in cell. Above tawny with black markings. F mv not swollen.

6 (7). Unh 2 dark lines in cell.

moorei, But. (55-60). The Small Tawny Wall. Simla—Sikkim. NR.

7 (6). Unh no dark lines in cell.

**satricus, Db.* (60-65). The Large Tawny Wall. Sikkim—Assam. NR.

D5. Orinoma.—The Tigerbrown. (Plate 12).

Above white with very broad dark brown veins and white spotted border Upf basal half cell orange with 2 black spots.

**damaris, Gray.* (75-80). The Tigerbrown. Kangra—Karens. NR.

D6. Cœnonympha.—The Heaths.

Above and below very dark brown with a single pupilled ocellus upf. Very like a small Erebia.

myops macmahoni, Swin. (35-40). The Baluchi Heath. Baluchistan VR.

(*To be continued.*)

REVIEWS.

(1) THE COMMON BIRDS OF INDIA. By Douglas Dewar. Illustrated by G. A. Levett-Yeats. Vol. I, Part 1. Rs. 2-8.

A popular and illustrated work on Indian birds has long been a *desideratum* and we have often received enquiries for one, so we hope this new work will receive the popularity it deserves. Everybody knows Mr. Dewar's ability in describing birds and their habits in popular phraseology and we have also seen the excellent illustrations by Mr. Levett-Yeats. The whole work, if completed, which depends on the sale of the first volume, will consist of some five volumes. Volume 1 which is now being published comprises three parts which will make the cost Rs. 7-8 and presumably the whole work will come to Rs. 37-8, but as the publishers are bringing it out in instalments this will not prove too heavy and is very cheap for the amount of information the work will contain.

The first volume deals with all the game birds. Part 1, which is before us, gives descriptions and accounts of all the Ducks and their Allies and consists of 44 pages with one coloured and fifteen black and white illustrations.

There are a few criticisms we should like to make on part 1. The list of vernacular names might have been more complete, very few of them hold good for the district in which the reviewer resides. We also think the simile of the various ducks to, winged bottles, is slightly far fetched and might have been omitted, but the resemblance of the head of the Red-crested Pochard drake to a ball of dull red worsted is rather apt. Greater use might also have been made of Mr. Stuart Baker's exhaustive articles on Indian ducks with regard to habits, nesting, etc. and a little more might have been said about the kind of water, etc. preferred by the different species, so as to enable the sportsman to know where they may be found.

We also note that the Flamingoes have been quite omitted although they belong to the same order, the *Chenomorphœ*, as the ducks; a few other omissions will be noted in the course of the review. The use of the words cock and hen as applied to ducks is unusual and not correct.

Mr. Dewar's descriptions though short are very correct and should enable anyone to identify any of the birds they shoot.

With regard to the Nukta, although it is not a very good table bird, the ducklings when fully fledged are well worth shooting for the pot. Mr. Dewar gives the bird as sometimes breeding in reeds, but we find no mention of this habit in Mr. Baker's article on this species. They have been known to nest in a hole both in a tree and in a bank and also occasionally to make use of other birds' nests in which to lay. As to the number of eggs laid, Mr. Livesey took a clutch of 47 from one nest.

Writing about the Spotted-billed Duck the author says it " is a larger bird " than the Nukta which is of course a mistake as may be seen from the measurements given of both species.

Pink-headed Ducks are apparently rare nowadays and the demand for live birds considerable. We have noticed offers of Rs. 100 each in the daily papers. In this district we have not seen more than a dozen of these birds in the course of the last 20 years. Mr. Dewar says nothing about the nesting of this species although it has been described; of late years few people, if any, have found their nests.

With regard to the White-eyed Duck as a table bird, the general concensus of opinion is that it is unpalatable, but in this district it is considered one of the best table birds.

While writing on the White-eyes, the author makes some remarks on the nomenclature of the present day. He has for many years been a steady opponent of the species maker and present day systematic or cabinet zoologist, and the writer, though not so bloodthirsty as to wish that the man who introduced the system of trinomials "had been drowned at birth", is inclined to agree with his views. Although one must admit that the differences between the various subspecies are fairly well marked *when* one has a series of birds from *many* localities in front of one, these differences are not in many cases sufficient to enable one, with birds from *one* locality to decide as to which subspecies they belong to. I quite fail to see the use of these trinomials except, perhaps, to show to a certain extent species in evolution. It seems absurd to call a White-eyed Duck, *Nyroca nyroca nyroca,* and what about such monstrosities as *Coccothraustes coccothraustes coccothraustes,* by which name, I understand, the Hawfinch is now known ? Still I suppose, it being the fashion to call birds by those names, one should, much though one dislikes it, attempt to keep up with the times and do as others do.

We agree with Finn in considering the Bronze-capped Teal more a duck than a teal and have had considerable experience of this bird.

Mr. Dewar says the only place the Sheldrake is likely to be seen is Sind, but it is evidently as rare there as in other places where it has occasionally been got. We have got some half dozen birds in this district, which is very many miles from the sea coast.

After dealing with the ducks and before going on to the swans, etc., the author gives a key which is generally very good but might have been improved upon, such as by adding as often as possible the more striking features of plumage. For instance under Pochard, the addition of "Pencilled back" would have made the identification easier ; also Finn's "Buff head with black and green stripes" seems to us to describe much better the Clucking Teal drake than Mr. Dewar's key does. However with the aid of this key we do not think anybody should have the slightest difficulty in placing their birds.

We now come to what the author calls "Swans, Geese and Pseudo-Ducks". The flamingoes might have come in here under the latter head. Mr. Dewar only mentions three swans as having occurred in India, but a reference to Mr. Stuart Baker's Game Birds would have shown him that a fourth, Alpheraky's Swan (*Cygnus minoe*), has also been got, it having been shot at Tubi, Campbellpur, by Mr. Hornsby in 1911. It resembles Bewick's Swan but has a different shaped bill and the yellow on the same is more orange.

Besides the places mentioned by Mr. Dewar, the Mute Swan has also been got in the Punjab on several occasions, and one was shot near Lahore. The Whooper has also been got in Sind. The only other Bewick's Swan not mentioned by the author was procured near Mardan on the North-West Frontier.

Mr. Dewar's remarks on the lack of brain in the Grey Lag Goose are very interesting. On three mornings in succession he bagged a goose out of some that were asleep on a sandbank near a high bank on the Ganges and although fired at they continued to return to the same spot each day. He was unfortunately unable to find out how long they would continue to do so as he had to leave camp.

It is true that Geese have changed very little by domestication but there is one peculiar freak, which is supposed to have come from Sebastopol, in which, according to Newton, the scapulars are "elongated, curled and spirally twisted."

Sushkin's Goose (*Anser neglectus*) has been omitted by Mr. Dewar. It is a bigger bird than the Pink-footed species, being about 30 inches long, and has the upper wing-coverts dark brown instead of the light ashy grey of *brachyrhynchus.* It has been got in Upper Assam.

With the exception of subspecies, every duck and its allies have been described, whether rare or common, with the exceptions noted and the Mandarin Duck (*Æx galericulata*), which is a small migratory non-diving duck of exquisite plumage and grace in the case of the drake. It is well known, being often kept at home on ornamental waters. The drake has a rosy-red bill, a coppery-red and metallic green crest, a ruff of chestnut hackles and a purplish breast. The most peculiar and a very beautiful feature of the drake is the expanded inner web of the innermost wing feather in each wing. It is chestnut in colour, and fan shaped, and often held perpendicular. The drake is perfectly aware of his own beauty and shows that he is. The only Indian specimen is one shot by Mr. Stevens in Upper Assam out of a party of six, and some others were seen by Mr. Stuart Baker.

The illustrations are mostly excellent and will prove most useful for the identification of the different birds depicted, with the exception of the Mute Swan (*Cygnus olor*) which is on far too small a scale to be of any use at all. It is a pity Mr. Levett-Yeats did not represent this species in one of the two swimming birds, the other being the Whooper (*Cygnus cygnus*) named *C. musicus* by the author—instead of depicting both as Whoopers. In the coloured frontispiece the brilliant green speculum on the wing of the Common Teal is not nearly bright enough, but this is probably the reproducer's fault. We especially like the illustration of the White-eyed Duck.

We look forward with pleasure to seeing the further issues of this most useful work and heartily commend it to all who are in any way interested in the vast avifauna of this country.

(2) THE FERNS OF BOMBAY. By Rev. E. Blatter, S.J. and Prof. J. F. R. D'Almeida, B.A., B.SC. Bombay, (Taraporevala, Rs. 7-8). (*From the Bulletin of the Royal Botanic Gardens, Kew.*)

A small octavo volume forming a convenient pocket guide to the wild and cultivated ferns of Bombay. The sequence followed is that of Hooker and Baker's Synopsis Filicum. It should not be difficult with the aid of the synopsis of the 54 genera, which comes at the end of the volume, and of the keys to the species which are found with each genus, for anyone, even without a previous botanical training, to find out the names of the local ferns. The systematic part is preceded by an introduction dealing shortly with the structure and life history of ferns. The letterpress is clearly printed and the figures should prove useful.

(3) FLORA SIMLENSIS. A Handbook of the Flowering Plants of Simla and the neighbourhood. 200 Illustrations and a Map.

By the late Colonel Sir HENRY COLLETTT, K.C.B., F.L.S.

(Second Impression. Thacker, Spink & Co., Calcutta and Simla, 1921. Price Rs. 30.)

It is almost twenty years ago that Collett's Flora Simlensis was published. The fact that the publishers were called upon to prepare a second impression speaks sufficiently for the value and popularity of the book. It is not a common occurrence that works on Indian Botany reach a second edition. The Indians are fond of flowers and trees—who will deny it—and they are anxious to know something about them, even if it were only their names or some superstitious usages connected with them,—but the knowledge must come to them without an effort; they do not want to open a book in order to learn the meaning of a few technical terms and then, step by step, to gain the information they are anxious to obtain. This is the reason why botanical books do not sell in India. It is fortunate that botanical writers do not depend on their publications for a livelihood. If our remarks are true in general, they apply in a special way to floristic works. We quite agree, they do not form absorbing reading, but we must admit at the same time that they form the foundation for the study of every other branch of botany, Horticulture and agriculture not excluded, and that even chemistry and pharmacy in their researches have to rely on the accuracy of systematic botany.

Sir Henry's Flora has one great advantage over many books of a similar type : it is profusely illustrated. Miss M. Smith has rendered the task of identifying plants much easier by her artistic and at the same time accurate and characteristic illustrations.

Those who use the Flora Simlensis will at once find that it is not a mere compilation but the outcome of conscientious and independent work. "Collett had the true scientific temperament. He had no respect for scientific authority and distrusted text-books. He was never content without verifying the facts for himself." (Thiselton-Dyer). This fact is apparent on every page of the Flora. Surely, a botanist like W. Botting Hemsley would not have written a long and interesting 'Introduction' to Collett's book if he had not been convinced of the great and lasting value of the Flora Simlensis.

(4) INDIAN BIRD LIFE. By Miss M. R. N. Holmer, M.A. (Oxford University Press, Bombay.)

We have received for review a little book by Miss M. R. N. Holmer, M.A., entitled 'Indian Bird Life', a book of bird study with a coloured frontispiece depicting the common birds of an Indian compound. The book has been written as a first guide to the new arrival in India who requires an introduction to even the most familiar birds of the country and a stepping stone to more detailed studies. To such it will undoubtedly be useful. The ideas underlying the construction are sound and the authoress writes pleasantly on a subject which evidently is near her heart. But the candid critic is constrained to admit that the work is uneven in its execution, contains a certain number of inaccuracies and mistakes, and appears to have been sent to press somewhat hurriedly without the final revision which would have shewn the authoress that it was still incomplete even according to her own *original* designs. For instance Appendix 4 Bibliography mentioned in the list of contents has not been included, and Appendix 1 has been expanded entirely beyond the scope indicated in the same list.

The book, however, may be welcomed as belonging to that class of Natural History literature addressed to the ordinary public and not to the serious student, which has been so well developed in Europe and America but is still sadly needed in Asia. On this account its shortcomings may be pardoned.

The text is divided into two Parts, part I deals with the Birds of the Plains, and Part II with Birds of the Hills. Part 1 contains an instructive chapter for the novice on the art of identification in the field, and another chapter to introduce him to the mysteries of scientific classification. Once these are mastered and the common birds described in the other chapters are recognised, both in the field and cabinet, the student will be ready for more detailed studies.

EDITORIAL.

The omission of an editorial from recent numbers of the Journal has not been due to the laziness of the editors, but to the size of the Journals and the necessity therefore of economy in some direction. We have not of late been able to economise in the matter of the Journal owing to our having fallen in arrears with the publication of papers sent to us, but we are now practically up to date and are able to issue the Journal in smaller parts. Hence the revival of the Editorial.

One of the papers in this number is making a very tardy appearance, the fault for which is the Editors, and we take this opportunity of apologising to the author, Col. Wall, for our remissness—" The Handlist of Indian Snakes " of which we publish the first part will be to "Ophiologists " what Stuart Baker's Hand List of Birds will be to Indian Ornithologists. Both Handlists have two things in common, they are the precursors of books to be published later in the Fauna of British India Series and they introduce changes in nomenclature which are certain to raise discussion from those who are conservative and like to remain true to their first loves—the names they first knew a snake or a bird by.

Mr. Stuart Baker's Hand List of Birds, which now only awaits the errata pages the author is preparing to appear in book form—the errata are we regret to say numerous—has given rise to a certain amount of criticism and in the miscellaneous notes published in this number we give one of these criticisms and Mr. StuartBaker's reply to this and to another critic as they show how willingly he accepts genuine criticism and how able he is to maintain his point of view.

We understand that it will be at least 5 years before the publication of the volumes on Birds in the Fauna is finished so it can be readily understood how necessary the Handlist of Birds will be to Indian Ornithologists during the next few years. The situation is somewhat similar with regard to snakes. We have the material for an authoritative illustrated book on snakes in the papers which have been issued in the Journal by Col. Wall under the heading " Popular Treatise on the Common Indian Snakes." This, together with material dealing with the rarer snakes and perhaps incorporating part of Col. Wall's Treatises on the Poisonous Snakes of India and the Sea Snakes of our Indian Seas, the Committee is anxious to publish in book form, and we understand Col. Wall is willing to revise the old papers and edit the book for us, but we cannot publish it until we have covered our liability on the publication of the first two volumes of the Game Birds of India.

We are curious people ! When the first edition of the first volume of Game Birds " the Indian Ducks " was out of print there was a big demand for it at the booksellers and as much as Rs. 75 was paid for a copy. A second edition is accordingly issued containing several improvements on the first. The new edition is obtainable at the Booksellers for Rs. 63 or by the members of the Society from the Society for Rs. 50, yet 50 per cent. of the volume on Ducks and 40 per cent. of the second volume dealing with the Woodcock, Snipe, Bustard and Sandgrouse remain unsold. Can members wonder if, when they write and ask us when the 3rd and 4th volumes are to be published we reply that it depends on members themselves. This is probably poor satisfaction to the member who thinks he has done his duty to the Society by buying its publications, but is there not a further duty laid on members ? Ought not members of a Society like ours to possess the missionary and advertising spirit ? Ought they not in season, and perhaps out of season, to be seized with the magnetic spirit of attraction and attract people into the Society's fold? Ought they not to advertise the Society's publications ? Whether they ought to or not, we wish they would. The Society needs new members and it wants to realize the money it has invested in its publications.

Whilst on this subject, members who served in the Mesopotamia Expeditionary Force will be glad to learn that, thanks to the public spirit of the Iraq Government and to the good offices of Sir Percy Cox and Sir Arnold Wilson we have received sufficient money to guarantee the issue without loss to the Society of the various papers dealing with the Fauna of Mesopotamia which appeared from time to time in the Society's Journal. The new publication will be called " A SURVEY OF IRAQ FAUNA, Mammals, Birds, Reptiles, etc., made by Members of the Mesopotamia Expeditionary Force, (D), 1915-1919," and, in addition to the papers already published, will contain a Preface, List of Contributors, Bibliography, Errata, etc. The price of the book will be Rs. 7—8 and members in India can send in their orders to the Society now. Those still in Mesopotamia should apply to the Times Publishing Company, Ltd., Bagdad and Basra, and those in England to the Society's Agents, Messrs. Dulau & Co., Ltd., 34-36, Margaret Street, Cavendish Square, London, W.

Before leaving the subject of books may we congratulate Father Blatter—though rather tardily we fear—on the publication of his book on the " Ferns of India" by Messrs. Taraporevala Sons & Co., Hornby Road, Bombay, and also congratulate Messrs. Thacker Spink & Co., Calcutta, on the publication by them of a new edition of Collet's " Flora Simlensis". The Himalayas are such a happy hunting ground for the botanist and lover of flowers that Messrs. Thacker & Co. must be filling with this new edition a long felt want.

During the past two months a great change has been wrought in the Natural History Section of the Prince of Wales' Museum and I must take this opportunity of congratulating my colleague, Mr. S. H. Prater, on the excellent advantage he took of his trip to England to study taxidermy under the experienced tuition of Mr. L. C. Harwood of Hammersmith. Not only has Mr. Prater brought back with him an excellent collection of mounted specimens, not only has he turned to good use his own artistic taste but he seems to have learnt how to teach others, and two or three of our Museum Assistants are developing under his fostering care into good taxidermists. So much is this the case that we are considering whether we cannot add to the Society's income and benefit members by undertaking taxidermy work for them. It will have to be on a small scale at first and we should prefer the mounting of heads and birds to the preparation of skins as rugs. It must be thoroughly understood that we accept no responsibility. Every possible care and attention will be paid to material sent to us. It was because of this question of responsibility, that we gave up some years ago getting trophies set up for members in Bombay. Some members would not understand that if a skin had not been properly looked after at the time it was shot nothing could be done with it afterwards. Some again did not understand that if a tiger's skin arrived minus the tiger's whiskers we were unable to supply the deficiency. We think Mr. Prater will make as good a representation of the animal in life as any one but even he cannot succeed with a badly cured skin.

Reverting to the Museum, we hope members will make a point when in Bombay of visiting both the Natural History Section of the Prince of Wales' Museum and also the Research Collections which are still maintained in the Society's Rooms at 6, Apollo Street. They will see in the former what knowledge combined with enthusiasm can do even when up against that enemy of progress the want of money. Where makeshifts have to take the place of expensive cases they reflect credit on the Museum staff because they show that the staff has not succumbed to the money difficulty but has risen superior to it. The Acting Curator (Mr. Ellison is in England) and his assistants will welcome criticisms and suggestions from members which are of a constructive nature.

This Editorial is being written at different times and the foregoing had gone to press before the last number of the journal had reached the hands of many members. We wish to thank those who made use of that journal, and the membership form sent with it, to obtain new members for the Society.

Whether it is due to the new proposal form, to the excellence of the journal or, as we believe, the personal endeavour of the member, the result is beneficial to the Society.

We were rather sceptical as to the value of the journal as an advertising medium because some firms which had had advertisements in our journal did not renew them. We are sceptical no longer. We advertised in the last issue a number of books surplus to the library and the result has been that we have sold, every book except :—

Game Birds of India, Burma and Ceylon, 3 Vols. Hume & Marshall.
Handbook to the Birds of the Bombay Presidency, Edwin Barnes.
Catalogue of the collection of Bird's eggs in the British Museum, 4 Vols.
Handlist of the Genera and Species of Birds, 4 Vols. R. Bowlder Sharpe.
Natural History of Indian Mammalia including Ceylon, Robert Sterndale.
Vertebrate Zoology of Sind, Murray.
British Museum Catalogue of Lizards, Vols. 1 & 11.
Proceedings of the Zoological Society of London, 21 Bound Volumes.
Transactions of the Zoological Society of London, 5 Vols.

and have had to write numerous letters of regret to members who applied too late for volumes already sold. The money realised will be utilised for binding Natural History periodicals, buying new volumes and also buying new book cases. Mr. McCann, who was formerly collecting for the Mammal Survey and who is now working in the Museum on the collection of Mammals, has taken in hand the care of the Library and its value is considerably increased thereby. We should like to record here our gratitude to Mr. T. R. D. Bell, I.F.S., C.I.E , who has enriched our library by the deposit in it of that very valuable work Genera Insectorum. It is profusely illustrated and 26 volumes have been completed.

BIRD MIGRATION.

Mr. G. Brown, of Balangoda, Ceylon, wishes to obtain records from India of the movements during the migrating period of the three Wagtails.

Motacilla cinera melanope
Motacilla flava thumbergia
Dendrognothus indicus

Will members interested kindly communicate with him.

OBITUARY.

P. J. Mead, C.S.I., C.I.E., I.C.S.

The late Mr. P. J. Mead, C.S.I., C.I.E., I.C.S., whose death at Mahableshwar on the 7th of April is universally regretted, was educated at Haileybury and King's College, Cambridge. He joined the I.C.S. in November 1894 and was posted to Ahmedabad, where he spent the greater part of the next six years including the terrible famine year of 1899-1900. 2½ years as Revenue Under Secretary and a few months as Private Secretary to the Governor followed, and he then returned to Ahmedabad as Talukdari Settlement Officer for 18 months. Work in Poona and Bombay as Director of Agriculture, on special duty to report on the development of Salsette, and as Census Superintendent, with intervals as Acting Collector of Surat and Bombay, came next, till the end of 1911, when temporary ill-health forced him to go on leave for nearly a year The next four years gave him experience of the Deccan as Collector of Ahmednagar, and then, after a period of furlough, he came to Bombay in October 1917 to take up the post of Director of Industries, which, owing to the requirements of the war, was one of great importance and difficulty. In April 1919, he became Chief Secretary to the Government of Bombay, in the Revenue and Financial Departments, and after another trip home on furlough returned as Chief Secretary in charge of the Finance Department, which, since the Reforms, had become the Pivotal Department, on which all the others to a great extent depended. His devoted and unflinching work in that most arduous post gained him the fullest confidence of His Excellency the Governor, of the Legislative Council, of the public, and of the members of every service, but made such heavy calls on his strength that he was unable to shake off the fever which attacked him, just as he had handed over charge of the Chief Secretaryship, on his appointment, which had been received with general approbation, to act as Commissioner in Sind. Of Mead it can be said with absolute truth that there was nothing which he touched which he did not adorn. His abilities were recognised by his appointment as C.I.E. in 1914 and as C.S.I. in 1921. His most lovable character endeared him to all whom he met, few of whom will forget his cheery smile and the kindly tones of his voice. To the young Assistant Collectors who received their early training from him, he was the most stimulating and inspiriting of instructors, for he combined the highest sense of duty with a love for and marked proficiency in every form of sport, an affectionate understanding of the people of the country, not least among them of the more jungly tribes, and a lively appreciation of the beautiful in nature, in antiquity and in literature. These same qualities accounted for no small part of his influence as colleague and adviser in the higher administrative posts.

In field sports he was perhaps most distinguished in cricket, having represented the Presidency four times, the first in 1895 and the last in 1903. He was a keen pigsticker before the great famine temporarily ruined pig-sticking in Gujerat, and he was a good small game shot.

The regard in which he was held by the Government is shown by the Resolution which was passed after his death, which runs as follows :—

" Government have learnt with feelings of the deepest regret of the death of Percy James Mead, C.S.I., C.I.E., I.C.S., in the 29th year of his service after a brief illness at Mahableshwar. Throughout the length of his service he worked with a single-hearted zeal and devotion to duty which earned the warmest appreciation of his superior officers in every appointment that he held. His great ability found its fullest scope in the post of Chief Secretary and Financial Secretary which he had just vacated after four years' tenure on appointment to act as Commissioner in Sind.

Government have fully recognised that the notable success which has crowned the introduction into this Presidency of the Reform Scheme has in large measure been due to his devoted labour and his unerring judgment.

A man of great personal charm, he endeared himself to all with whom he came into contact and his sudden death will be universally mourned throughout the Presidency."

Mr. Mead became a member of our Society in 1894 and joined the Committee in 1919. Although his duties called him often from Bombay he was always willing both before and after he joined the Committee to give his help and advice, and both Mr. Millard and the present Honorary Secretary bear grateful testimony to the help Mr. Mead was to them. His advice was specially valuable during the negotiations for the transfer of the Society's collections to the Natural History Section of the Prince of Wales' Museum.

Mr. Mead was twice married. He leaves a son and a daughter by his first wife, and a son and a daughter by his second wife, who survives him. To Mrs. Mead and to the children the Bombay Natural History Society offers its deepest sympathy.

ALEXANDER MELFORT PRIMROSE.

It is with deep regret that we have to announce the death of Mr. Alexander Melfort Primrose, one of our oldest and most esteemed members. He died at Brndi in Gwalior on the 10th August 1922 at the comparatively early age of just over fifty.

He came out to India in 1888 at the age of 16 and worked for some time with Messrs. Binny & Co., of Madras. In 1893 he joined his uncle, the late Mr. Patrick Campbell, in Cachar and about the end of the same year started his career in tea on the Bagh-o-Bahar tea garden. This was a new garden which he had to open out and as most of the land was under forest he was able to indulge, to a very large extent, his taste in Natural History of all sorts and it was here that were spent his most successful collecting days. The writer first met Primrose, who to his intimate friends was always known as Prime, when on this garden, about the year 1894, and from then till the end of his days we were life-long friends.

He subsequently went to the Surma and Rema tea gardens in South Sylhet, remaining there till early in 1902. While there he was fortunate in getting a nice series of that beautiful little Sunbird *Cyrtostomus brasiliana* and on a visit to his uncle in Cachar, specimens of the rare Masked Finfoot (*Heliopais personata*).

After leaving Sylhet, Primrose migrated to the Nilgiris where he stayed on the Terramia and Halashana gardens till early 1904, thence going to Churamullah in the South Wynaad. He only remained there a very short time as the climate was very deadly. He was unfortunate in his collecting here as he got a batch of cartridges from a Madras firm, from which, when exploded, the shot simply rolled out of the barrels.

About the end of the same year he left the South, joining the Sonthal Mission garden of Mornai in the Goalpara district of Assam. This was situated far away from a railway station and from any other European ; his sole companion being the Forest Officer when he happened to inhabit the forest bungalow close by. Although Mornai was very far from being a health resort, Primrose spent many happy days there, due to being in the proximity of the forest and of the Sankos, then an excellent *Mahseer* river. There was also good shooting to be had, such as Bengal florican, black and swamp partridge, and several species of quail. I spent many never to be forgotten days here with him, either shooting, bird nesting, or down by the river, and it was here that we got the new sub-species of quail, *Microperdix manipurensis inglisi*, which, had he not been so loth to put pen to paper, besides being no believer in small sub-specific variations, should have honoured his name instead of mine. We also got here the eggs of that exquisite little Cuckoo, *Chalcococcyx maculatus*. Primrose stayed at Mornai till January 1908 and on losing his appointment we both went for a month's trip, with the late Mr. Monteith of the Forest Service, to the Aie river on the border of Bhutan. These were most enjoyable days, and Primrose and our host did a lot of fishing and on off days the former joined me in collecting. It was here we first met the Ibis bill (*Ibidorhynchus struthersi*) and I can remember with what delight we picked up our first specimens.

His next billet was at Longview, in the Darjiling district, where he worked from 1910-13. I visited him several times while he was there and, though only on rare occasions was he able to accompany me with a gun, I spent a very happy holiday. After leaving Longview he returned to Mornai but only for a few months.

Subsequently Primrose went to Assam where he remained till near the end of 1921, the last garden he was on being Murphulani in the midst of the forest. This was also an opening out billet. He spent a fairly happy time here as he had lots of work to do in which he was very keen, and some recreation in the way of fishing and shooting. Both my brother and myself visited him here and had a most pleasant time. After leaving Assam he came to stay with us and remained till April 1922, shortly after which he joined his brother Colin in Gwalior, where he contracted a very severe attack of typhoid from which he never recovered.

After leaving Sylhet he practically stopped collecting though he did a certain amount of it at Mornai. His collections of skins, eggs were, I think, purchased by the late Dr. H. N. Coltart.

Primrose took an interest in Natural History, principally birds, from his earliest days, and as a boy was an expert with the catapult and by that means made a good collection of British birds, which, however, he did not keep. His activities were by no means confined to birds, as when in Sylhet he made a fine collection of snakes. He was also fond of painting in water colours and photography, being no mean adept in those arts, and, as in everything else he undertook, he worked at them in a thorough and painstaking manner. He was extremely neat in all he did and turned out most beautiful specimens. In his younger days he was fond of riding and up to the last was an excellent shot both with a rifle and shot gun, being able, with a ·22 bore to place his shot wherever he liked.

Primrose was sparsely built but with extraordinary stamina and could outwalk most men of half his age. In disposition he was retiring and excessively kind hearted but too non-assertive to get on in life. He was also most sensitive and took to heart small things that others would have passed over. His hospitality was great and there was nothing he enjoyed more than having one or two pals of kindred taste round him, and his bungalow and all he had was always at their service, neither trouble nor expense being considered in entertaining his guest. His heart was too good for his purse and he thought nothing of scrimping and depriving himself so as to be able to help a lame dog over a stile, even if unknown to him. He was a sound planter, hardworking and conscientious to a fault, and never did a soul a bad turn, although he had received many hard knocks during his career. As a naturalist he was exceedingly observant and a true field ornithologist, being no lover of the present day minute differentialities nor of "dry as dust" lists, and the writer was often chaffed by him about some of his writings which appertained to that description. He was a fund of valuable knowledge and, as his writings were few, much has been lost to science on account of his great distate for "ink-slinging." Primrose was a staunch friend and most interesting companion during rambles in the forest, there being scarcely a creature about which he could not give some interesting and instructive information. He was a good son and brother and will be greatly missed by his brothers and sisters and many loving friends. To me his loss is irreparable, and nature loses a keen and sympathetic observer.

C. M. I.

MISCELLANEOUS NOTES.

No. I.—NOTES ON TIGERS AND THEIR CALLS.

There is no doubt that the tiger calls some times like a sambhur, as has been described not only by Major H. H. Harington and Mr. J. W. Best in the Bombay Natural History Society's Journal of the 31st October 1911, but by other observers, *vide* pages 792, 793 and 794 of Volume XXVIII, No. 3 of the Society's Journal published on the 30th June 1922, but no one appears to have got a hold of the tiger's real reasons for making these "titting" noises or calls.

The call, or "titting" of a tiger, as the Burmese refer to it, is often heard in Burma, but is not necessarily a hunting call or one uttered when one tiger is keeping its mate notified of its whereabouts.

If any thing, the note is one of apprehension uttered by the animal when it is in doubt or when it has been suddenly disturbed, or alarmed by human agency.

For instance at Sinbo, in the Myitkyina District, when I was sitting up for a very large male tiger, which I eventually bagged, the beast, although the machan was situated within 150 yards of a village and by the side of an open cart road, turned up in a neighbouring plantain grove, within about 150 yards of the kill, and by the side of an open cart road, and began uttering his "titting" calls, at intervals, at about 6-30 p.m. when there was still plenty of day light. At the time a few villagers were passing to and fro, between the tiger and its kill, along a cart track which led to the village, whilst others were driving their cattle along the same road. I knew perfectly well at the time that the animal, which was emitting the calls, could only be the tiger I was waiting for, and that they could not have been made by a sambhur, because, apart from former experiences of tigers calling, I knew that no sambhur ever entered the plantain grove in question.

There can be no doubt that this tiger was very anxious to get to its kill, a large cow which, when I first saw it and had dragged out to a suitable site for a machan near the road, was situated in a dense patch of tree jungle about 40 paces to the rear of the spot where the machan was put up.

Of course one can only make conjectures as to the animal's reasons for making these "titting" noises or imitation sambhur calls. It seems to me however only reasonable to assume, that the tiger in this case, whilst on the move towards the carcase of the cow, which he had killed the evening before and had had as yet only one meal off, was somewhat perturbed on hearing voices and the deep notes emitted from the wooden "kalauks" or bells hanging round the necks of the cattle, as they were being driven past into the village, to be penned in for the night, in close proximity to the spot where he had left his victim, and that these subdued notes or calls were uttered by him either whilst in a suspicious or discomfited frame of mind, or as a sign of his fear or displeasure, or as a warning to both man and beast that he was in the vicinity, for the animal had no mate with it ; of that I am certain

On another occasion, in Arakan, at a place called Lehnyindaung, I was informed one afternoon, rather too late to enable me to have a machan erected before dusk, that a tiger had killed a cow, about 4 days before my arrival, in the paddy fields near some low lying hills and that there were still a few bones and one leg of the animal left, which would probably be visited as usual by the tiger that night, as he had been seen in the vicinity the night before. I accordingly hurried away at once to the spot, and, arriving there at about 5-30 p.m., had the remains of the cow gathered together, out of the small nullah, and taken to a more suitable spot at the foot of a solitary tree in the open fields where they were firmly tied down and staked to the ground.

Whilst the men were only half finished with the erection of the machan, it being then nearly 7 p.m., the tiger, from a neighbouring height at a distance of about from three to four hundred yards, began at regular intervals "titting" for all he was worth. There was not the least doubt that, in this case, the tiger had been on the move down the bamboo covered hills towards the kill, and had then been brought up suddenly on hearing the men talking and using their wood choppers in the vicinity of the kill, and that it was then only that the short sharp nervous notes or calls of alarm began to be uttered at intervals.

There is no mistaking the "titting" calls of a tiger when they are emitted in a locality where there are no sambhur, but many sportsmen have been deceived into believing that the calls were uttered by a sambhur, instead of a tiger, and even local jungle people cannot always distinguish between the two calls.

The correctness of the conjecture as to which animal was calling, a sambhur or a tiger, would also, to a certain extent, often depend a good deal on the state of the weather and stillness of the air and other conditions prevailing at the time when they were heard, and also on the distance.

I have enquired of hunters of all nationalities in this country to explain why tigers should call by "titting" like a sambhur, but none of them could ever give me any really satisfactory explanation, and not one of them even put forward the theories that they did so (1) to warn or call a mate, (2) as a note of doubt or alarm, which in my humble opinion is the true and only reason, (3) to deceive sambhur and other game so that they might make a rapid detour and stalk them or make them fall an easy prey by stampeding them towards them or by causing them to stand stock still through fear till they had stalked them.

Why should a tiger want to call at all in order to deceive or cause game to stampede into him, when he is capable of stalking and springing upon animals, without these artificies, especially when the ground is damp ? The answer to this might in part no doubt be that the odour which emanates from a tiger, often tends to warn most animals of his presence, and that he has great difficulty in stalking during the hot season, except in the beds of streams and at pools, owing to the dry condition of the ground.

I could go further into this interesting subject and give also several other instances when I have heard tiger utter their sambhur-like "titting" bells, but want of space will not permit of my doing so.

I think I can safely say however that tigers only utter these peculiar calls or bells of alarm when suspicious or alarmed suddenly.

The Burmese have a well known proverb : "*Lu-kyauk-yin-hit-te. Kya-kyauk-yin-tit-te*" which literally translated means "When a man is alarmed he utters an exclamation such as "Hit Te" whilst a tiger when alarmed "tits".

W. S. THOM,
Deputy Commissioner, Hill Dist. of Arakan.

No. II.—STRANGE BEHAVIOUR OF A PANTHER (*F. PARDUS*).

A fortnight ago, while out shooting with a friend some 40 miles from Bombay, we had an interesting experience with a panther.

It was towards noon and we were beating some light jungle for anything it might contain. We were both posted and could hear the beaters approaching in the distance. All at once there was a great noise and we could hear shouts of "bagh." After some discussion our gunbearers hurried us back through the beat to a fairly open space overgrown with grass and a few bushes. Here we found the beaters collected and from their excited talk learnt that they had seen a panther and that it was supposed to be lying up in the grass close by. We ridiculed this idea but, as the men persisted, walked into the grass and found the panther right enough, crouching full length under a small bush, not more than 10 paces from where we had been discussing him. He held his head close to the ground, was in fact in the position of a cat about to pounce on its prey, and was staring hard, but made neither sound nor movement before the ball reached him. Though not a big animal (he measured 6½ feet between upright sticks) he was, to judge by his fangs, quite a full grown male. He was exceptionally fat and heavy for an animal of his size.

The question which occurred to us naturally was how such a cute animal as a panther could have remained in such insufficient cover when he was discovered by the beaters, one of which stated that he nearly hit the panther with his bamboo. More strange still was that all the subsequent shouting and talking close to him failed to move him.

BOMBAY,
17th March 1923.

S. HANHART.

No. III.—A PORCUPINE-PANTHER INCIDENT.

It might interest members to know that, while a panther was drinking water the other night a porcupine arrived and wished to have a drink also. The pool, being a very small one, did not afford elbow room for both, and the porcupine, in his stilted manner, walked round to the rear of the panther and attacked it. The panther sprang over the pool and continued to lap up water. As this did not suit the views of the porcupine he went round to renew the attack, but on this occasion the panther would not wait, but made off.

There were two people watching and one is positive that, in attacking, the porcupine turned round and backed into the panther. The other one is not sure. My experience is that porcupines turn round and charge.

What is the fact ?

TONK RAJ, RAJPUTANA,
26th May 1923.

E. T. FERGUSON.

[The porcupine's methods of attack have been previously commented upon in the Society's Journal (*Vide* Vol. XXVI, pp. 282-283). The offensive tactics adopted by the animal would appear to be a quick *backward* rush in the direction of his objective with the purpose of establishing contact with his formidable battery of sharp pointed quills. The theory that porcupines are able to "shoot" their quills can be disregarded.—EDS.]

No. IV.—THE MISHMI TAKIN (*BUDORCAS TAXICOLOR*).

I saw a herd of Takin in this district in an uninhabited valley forming a dividing line between the Digaru Mishmis and the Chulikatta Mishmis. The range bounding the eastern side of the valley rises in peaks to 9,620′. The western side of the end nearest the plains is very precipitous. The Takin seem to wander in the dense evergreen forest on the precipitous western side. The rainfall varies from 400″ to 150″ at least. From their track they would seem seldom to come below 3 or 4,000′ but would seem to be equally at home in the dense tropical evergreen at this elevation as in the rhododendrons and bamboos at

8 and 9,000′. They probably keep higher in the rains and come down in the cold weather.

Any place where a herd has halted is marked for years afterwards by their barking the trees by rubbing the thick base of their horns against them. The shape of the head looks very like that of a gaur on a smaller scale, except that it is of course narrower at the base of the horns. They have a wide flat nose like a cow's rather than a goat's. Their droppings are also the same as a cow's rather than a goat's. The build and shape of the body reminds one very much of a pig. If viewed from a distance, end on, their rolling gait reminds one of a bear.

There were 33 in the salt lick where I went to shoot them. One large herd of 29 and a smaller one of 4. The large herd was led by an old male who was lying down below the main part of the herd and, on spotting us and getting the wind of a man I had sent to close the other path out of the salt lick, he took his herd away and got to the path before it could be closed. Their sight is bad, that is, like most herbivorous animals,they cannot determine what a distant object is without long practice or being assisted by scent. According to the Mishmis, who have been hunting them for years, their sense of scent is very keen. A small fire lighted in a valley below them 2 or 3 miles away is said to drive them out of the valley.

Contrary to Capt. Bailey's experience, the herd I went after went right away after they saw us and I could not get them again though I spent two days trying to do so.

The adult animals here were all dun coloured on the withers, neck, and down the back, passing to black on the hind quarters. The young were all black; young males not quite full grown were reddish-brown in front and black behind horns as per Capt. Bailey's plates and description on pages 1069 to 1071 of Vol. XXI of the Society's Journal. I only took measurements of one of the cows I shot, I give them below. They agree with Capt. Bailey's rather than with those given in Blanford.

Female.

Length, nose to root of tail (between uprights)	5′ 6¾″
Height, shoulder to heel..	3′ 9½″
Girth, forearm	16⅜″
Girth at back of shoulder	5′ 7⅜″
Horns	14½″ × 9½″
Skull	16″ × 7″
Tail, not measured, about	3″—4″.

SADIYA, ASSAM,
7th December 1922.

H. L. COOPER.

[Commenting on the above note, Mr. J. P. Mills writes: "I consider it very interesting that Takin should have been found on a range which only goes up to 9,620,′ and that they are quite at home at 3,000—4,000′. This means that the Saramatti Range between here and Burma must contain ample ground high enough for Takin. The horns I got in a deserted Kuki village in April 1918 may well have come from there (*vide* Journ. B. N. H. S., Vol. XXVI, p. 24, *ibid*, Kingdom Ward, p. 838). The old objection was that there was not enough high ground for them there and so I could never rid my mind of a feeling that the horns may have been got by the Kuki owner from some Naga, who in turn got them from another Naga who went on the Abor Expedition. Though we shall not know for certain till the country is explored, I feel much more optimistic now that the Kuki horns are from a previously unknown Takin area. Saramatti is 12,622."]

No. V.—NOTE ON THE GORAL (*NEMHORÆDUS GORAL*).

While stalking tahr last November above the Dwali bungalow on the road to the Pindari glacier in the Almora District, I came on a solitary goral at an elevation of about 13,000′—14,000′. I had the animal under observation for sometime, at a distance of about 200 yards, and should say it was a male with about 8 inch horns. The animal was entirely cut off from all lower ground, being on the promontory formed by two glacier fed streams, the Pindar and the Kaphini, the lowest point of the promontory being 9,000′. Is it not uncommon to find goral at such an elevation ? Another point of interest is how he got to his present habitat, the nearest known herd of goral being on the Dhalsuri ridge some eight miles in a straight line across the Kaphini. Did he swim, or cross one of the temporary bridges built by the shepherds in the summer, or did he go round by the snow at the head of the Kaphini stream ? Also what was he doing so far from the herd?

ALMORA, U. P., R. H. PADDISON.
16*th December* 1922.

[As regards the altitude at which the Himalayan Goral is found, both Blanford and Lyddeker state that the animals commonly occur between 3,000 and 8,000 feet. Major F. M. Bailey writing in this connection states: "The highest I have known them was this year in Bhutan at about 11,000 feet on the Chu Lai La. I actually saw one animal there but could not be certain. It was not a musk deer but the people told me goral were common. We get them in Sikkim up to 9,000′ and I have also shot them at that height both in Eastern Tibet and Western China but the animals were of different species from the Himalayan ones."—EDS.]

No. VI.—THE LARGER MAMMALS OF THE NELLIAMPATHY HILLS.

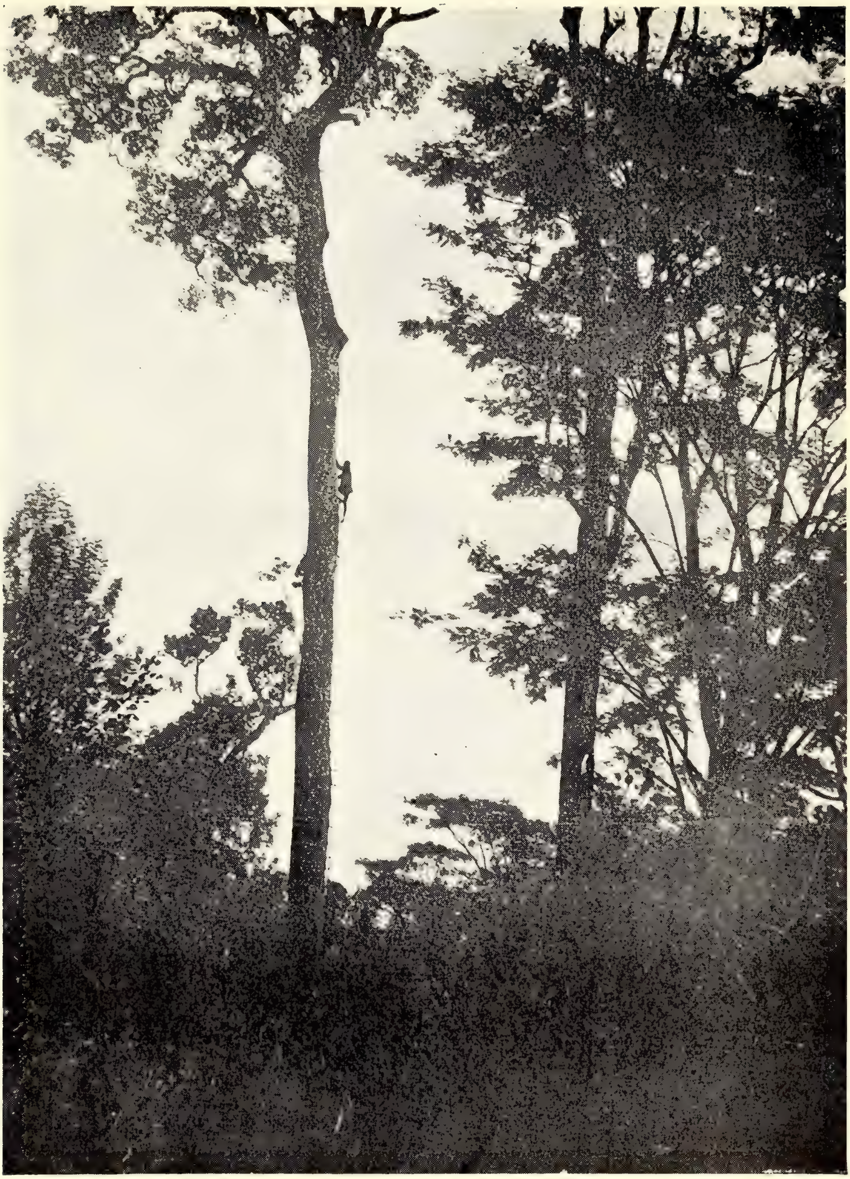
(*With a Plate*).

(1) The Bonnet Monkey (*Macaca sinica*) occurs in moderate sized troops on the northern cliffs and in the bamboo forest on the southern slopes but does not penetrate into the evergreen jungle of the plateau. (Vern. *Corongu.*)

(2) The Lion Tailed Monkey (*Macaca ferox*) is a rare animal. Small troops, rarely consisting of more than a dozen individuals, occur sparingly throughout the evergreen forest. This is a quiet animal, its conversation usually consisting of but one note, a deep " O ". When young it makes a nicer pet than most monkeys, being far cleaner in its habits than, for instance, the bonnet monkey. A full grown male is a fine looking beast, his great white ruff contrasting well with his jet black body. (Vern. *Carapu corongu.*)

3. The Nilgiri Langur (*Pithecus johni*). As late as ten years ago this monkey was extremely common on these hills and their deep booming, " Hoo-ha-Hoo-ha-Hoo-ha-Hoo-ha-Hoo " was one of the commonest sounds of the district, being heard from one point or another all day long. Constant persecution has sadly reduced their numbers and, though still far from rare, they are now by no means common. Indians, the jungle Mulcers and Kadars and the coffee estate coolies especially, attach medicinal value to their flesh of which they are inordinately fond. This species is restricted to the evergreen forest. (Vern. *Mandi.*)

4. The Malabar Langur (*Pithecus hypoleucos*). Decidedly rare, a very occasional troop of not more than half a dozen monkeys may occasionally be found on the Northern cliffs. Compared with the Nilgiri Langur or " Black Monkey " his is a silent species. Seldom, if ever, found in evergreen forest. The Mulcers



A MULCER, CLIMBING FOR HONEY, DRIVING IN PEGS AS HE CLIMBS.

will eat the flesh but do not consider it such valuable medicine as that of No. 3 (Vern. *Velle Mandi.*)

5. The Tiger (***Felis tigris***). The tiger is relatively common up here from September to June and grows large. When one is shot, another soon comes up and takes on the dead animal's beat. It is a curious fact that whereas "tie-ups" are almost useless in British Nelliampathy, kills are of frequent occurrence across the border in Cochin territory. A friend of mine has lost about half a dozen head of cattle and a horse in the last year or so on the Cochin side. I might as well state here, to save repetition, that all the large mammals leave the hills at the burst of the South-West Monsoon and return in September. (Vern. *Narri.*)

6. The Panther (***Felis pardus***). Quite common. They run small in size and dark in colour; black panthers are also comparatively common. (Vern. *Chinna narri*).

7. The Leopard Cat (***Felis bengalensis***). The commonest of the wild cats up here. (Vern. *Katu punne*). My father has a note in the journal (Vol. XXVII, p. 623) on a tame specimen of this cat which was captured on these hills.

8. The Palm Civet (***Paradoxurus niger***). Very common but seldom seen. When the coffee is ripe this civet would seem to live largely on these berries, leaving a trial of undigested 'parchment' as the beans themselves are called, on the road or along fallen logs. (Vern. *Merugu.*)

There is another Civet* up here, judging from its droppings considerably larger than the toddy-cat, but I have never seen it.

9. The Ruddy Mongoose. (***Mungos smithi***). This is the only mongoose I have come across on the hills. It is not common—(Vern. *Seruppu Kiri.*)

10. The Stripe-necked Mongoose (***Mungos viticollis***). Since compiling the above list I have seen the stripe-necked mongoose up here. I was sitting over a kill awaiting a panther's return thereto and watched a couple of these mongoose hunting round about below the machan for over half an hour. They were red; tail ripped with black; legs dark in colour (the legs looked black but I could not quite make out the shade); head grey; nose pink. They stood higher on their legs than *M. smithi*. The black neck stripes were very conspicuous.

11. The Wild Dog (***Cyon dukhunensis***). Far too common. (Vern. *Katu nai*).

12. The Nilgiri Marten (***Mustela gwatkinsi***). One of this species I shot lately, the only one I or anybody else has seen up here. The specimen is a female with milk so I hope to be able to find the young but have not succeeded in a first search for them. She was infested with ticks of a most active and prying disposition.

13. The Sloth Bear (***Melursus ursinus***). The bear used to be common on these hills till quite recently but is very rarely seen now-a-days. I have

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* [It is possible that the large civet referred to by Mr. Kinloch is the Malabar Civet Cat (*Viverra civettina*) which Jerdon describes "as being found throughout the Malabar coast from the latitude of Honore at all events to Cape Comorin." This animal measures about 4 feet from the tip of the nose to the tip of the tail and his colouration approximates to that of the Large Indian Civet (*V. zibetha*) of Bengal and Assam. It is a dusky grey with large transverse dark marks on the back and sides, the throat is white and the tail ringed black and white alternately. The animal appears to be a most elusive beast and at one time its existence was in doubt. It is hardly represented in Museum collections. There was, and perhaps is at present, a mounted specimen in the Madras Museum. A few years ago the Society made an effort to obtain skins and skulls of this animal from members residing in South India. Eventually two specimens were obtained from the Travancore Zoo. Any further information or evidence in regard to this Civet would be of interest.—EDS.]

not seen a track for four years. This is curious as the southern slopes of the range, towards the East, consist of typical bear country. (Vern. *Karadi*).

14. The Grey Flying Squirrel (*Petaurista philippensis*). Common, but more often heard than seen. The Mulcers, who eat anything and everything, take it in the holes of hollow trees where it spends the day. (Vern. *Mayapunne*).

15. The Large Indian Squirrel (*Ratufa indica maxima*). Very common throughout the hills. Their loud rattling note carries to a considerable distance. Their 'nests', great piles of dead leaves, are very conspicuous and it is a wonder they have not long been exterminated as the Mulcers climb like monkeys and are by no means averse to a dish of young squirrel. (Vern. *Malle enna*).

16. The Porcupine (*Hystrix leucura*). Common but seldom seen—an intolerable pest to gardeners. (Vern. *Mullampanni*).

17. The Hare (*Lepus nigricollis*). Common (Vern. *Mussal moilu*).

18. The Elephant (*Elephas maximus*). This animal is a perfect pest on the Nelliampathies throughout the dry months. Every planter on the hills has been chased at least once by elephants, and in 1911 Mr. Barnett was killed by one. Another planter a few years ago, came upon one on his tennis court early in the morning and was chased into his bungalow, the brute passing his front door and going through between his kitchen and servants' godown. I was once chased with my father without the slightest provocation. The greatest danger is when one happens to get benighted as the elephants use all the estate roads and come right up to the bungalows to feed on the plantains, etc. (Vern. *Ane*).

19. The Gaur (*Bibos gaurus*). Common, but the heads are comparatively small, a spread of 36″ being quite good for these hills. A few years ago a full grown bull fell into an elephant pit after having been badly mauled by a tiger. (Vern. *Kati.*)

20. The Nilgiri Tahr (*Hemitragus hylocrius*). Still common; on the Lily downs, in Cochin Nelliampathy, herds of 60 or more occur. Incidentally a friend and I, one morning, counted over eighty Nilgiri tahr, nearly all females with kids and a few immature bucks. The adult bucks at this season of the year (April) desert the herds and are seldom come across. Some good heads exist, one, shot in January 1923, measured 15⅞″ and another in November 1922 taped 15¾. Panthers feed largely on Tahr, and a tiger was recently seen on the precipitous cliffs, presumably after the same game. (Vern. *Varreadul.*)

21. The Wild Boar (*Sus cristatus*). Common throughout the hills. (Vern. *Panni*).

22. The Muntjac or "Jungle sheep" (*Muntiacus malabaricus*). Extremely common; about the only large mammal that does not leave the hills during the S.W. monsoon. (Vern. *Katadu, Keleman*).

23. The Sambhur (*Rusa unicolor*). Still common but terribly reduced in numbers during the past ten years, chiefly by poaching in the low country when they leave the hills at the start of the S.W. monsoon. Heads do not run large, 35″-36″ being considered very good. (Vern. *Kaddaman-Malleman*).

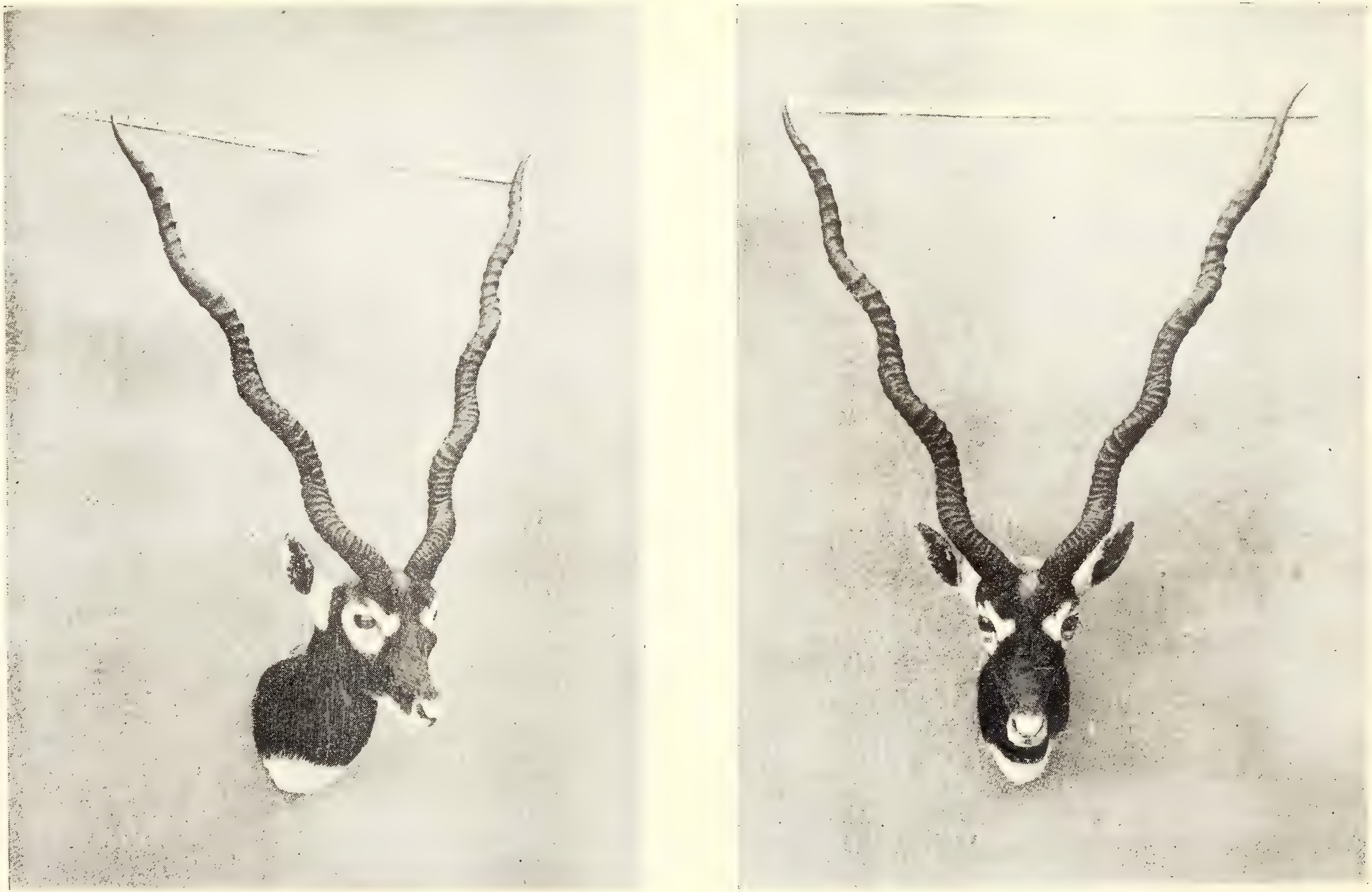
24. The Spotted Deer (*Axis axis*). Does not really come into the Nelliampathy fauna at all but some years ago a few deer came up into the evergreen forest to a height of 3,500 ft., where they were repeatedly seen for sometime. (Vern. *Puliman.*)

25. The Mouse deer (*Tragulus meminna*). Very common everywhere; they make the most delightful pets and are very easy to bring up. Unfortunately the Mulcers trap great numbers of them. (Vern. *Kurrompanni.*)

NELLIAMPATHY HILLS,
10*th Februnry* 1923.

A. P. KINLOCH, F.Z.S., M.B.O.U.

Note.—A description of the Nelliampathy Hills appeared in Miscellaneous notes No. XI, Vol. XXVII, page 939.



THE RECORD BLACK-BUCK (*Antilope cervicapra*), JHIND STATE.

No. VII.—TREE-SHREWS, TSINE AND SEROWS.

In his remarks on the name and habits of the Tree-shrew, Mr. C. Primrose writes with the little knowledge which is dangerous (Journ. Bombay N. H. Soc., XXVIII, p. 796). It is true that the continental races of this animal are not arboreal; but there are several insular forms which are.

In my book "In the Andamans and Nicobars" I wrote in 1903 of the Nicobar animals "unlike their representatives in the Malay Peninsula, which are ground animals, we saw them only in trees" (p. 122) and "These appear to be entirely arboreal in habits and are quite as active as squirrels in running along branches or climbing about amongst smaller twigs."

Again in the "Journal of the Federated Malay States Museums," IV, 1911, p. 191, when describing a subspecies from an island off the east coast of the Malay Peninsula, I wrote "Of the numerous species of *Tupaia* which I have collected personally, *T. longicauda* with *T. nicobarica* Zelebor, and its subspecies *T. n. surda* Miller, alone are truly arboreal in habit. As a rule the so-called "tree-shrews" are seen and trapped on the ground where they live and feed, or, at most, climb occasionally into low bushes: in them the tail is shorter than the head and body length. The above-named animals, which are met with in high trees and have the habits of squirrels, all possess a tail that is considerably longer than the length of head and body."

With regard to the Indo-Chinese race of the Tsine (*Bos banteng*) Mr. K. G. Gairdner has published a photograph of a spotted bull accompanied by some notes in the "Journal of the Natural History Society of Siam," II, 1917, pp. 250-1, and in the same volume there are some remarks of mine on the animal (pp. 316-7) throwing doubt on the validity of a distinct Siamese race and also upon the occurrence of the species in the south of the Malay Peninsula, of the locality of Lydekker's supposed *B. b. butleri.*

Then as to the Serow of Burma; in the south-east at any rate, I suggest that this belongs to the race recently described by me from S. W. Siam, *Capricornis sumatraensis annectens* (Journ. Nat. Hist. Soc. Siam. III, 1919, p. 391-2) which is a subspecies intermediate between *C. s. milne-edwardsi* from Szechuan and *C. s. swettenhami* from Perak, S. Malay Peninsula. It differs from the first in having the lower part of the limbs largely rufous, and from the latter in having the rufous colour not extending above the knees and hocks.

KUALA LUMPUR, C. BODEN KLOSS.
FEDERATED MALAY STATES.

No. VIII.—THE RECORD BLACK BUCK HEAD. (*ANTILOPE CERVICAPRA*). (*With a Plate.*)

In the 'Field' of April 26th, 1923, we noticed a reference to a magnificent Black Buck head which had been shot in the Jhind State. The measurements give undoubtedly constituted a record.

Wishing to confirm the correctness of these measurements we wrote to H. H. the Maharaja Rajendra Bahadur of Jhind and asked him if he could send us a photo of the horns, and any information in regard to the animal. We also offered to have the head mounted by the Society's taxidermists. H. H. kindly acceded to our request and sent us the head, which has been set up and we reproduce a photo.

The measurements are as follows:—

Right horn, from base to tip	30″
Left horn, from base to tip	31⅞″
Between tips	28¾″
Circumference	5″

It is practically a royal so far as length to spread goes. The animal was shot in Jhind State.

The previous known record was the head in the possession of Capt. J. MacRae Gilstrap, which measured 30½″.

EDITORS.

No. IX.—THE TRINOMIAL SYSTEM OF NOMENCLATURE AS APPLIED TO INDIAN BIRDS.

Readers of this journal will be aware that for the past two years or so a Hand-List of the Birds of India, revised according to the above system by Mr. E. C. Stuart Baker, has been coming out in instalments and is now nearing completion and issue in book form.

It is not my intention to criticise the system which forms the title of this article, indeed I have welcomed its introduction as a necessary step towards the proper recognition of local races of birds. What I do wish to urge most emphatically is the importance of adopting an authoritative standard list of Indian birds which will secure *finality in nomenclature. Turdus* gives way to *Merula* and *Merula* in its turn succumbs to *Planesticus.* I may be pessimistic, but I have a presentiment that even now some one is busy making out a case for the abolition of *Planesticus* in favour of some more obscure name. However this may be we can but adopt the accepted list of our time and presumably Mr. Stuart Baker's list above referred to will be accepted generally as the authoritative standard list for India, seeing that the author has been entrusted with the revision of the four volumes of the avi-fauna of British India.

Having got our standard list, it is essential that we should stick to it with the greatest care, both as regards trivial and scientific designations, and *never* refer to a bird by one of its other synonyms, which may have been attributed to it in the past by Blyth, Hodgson, Brooks, &c. If each and every ornithologist is free to select his own pet synonym for a bird and in addition to dub it with his own trivial name the result will be chaos, and nomenclature will lose its essential value.

That this note of warning is not altogether uncalled for will, I think, be admitted by any one taking the trouble to compare the names of the birds described in a recent publication by Mr. Hugh Whistler, one of India's ablest Ornithologists, *viz*, in his "Contribution to the Ornithology of Cashmere" which will be found at page 990 of No. 4, Vol. XXVIII of this journal. A 116 different species are referred to in this article, in 54 of which the trivial names differ more or less from those in Mr. Baker's list. Several of Mr. Whistler's trivial names are in my humble opinion preferable to those of the list, *e.g.*, the Siberian Chiff Chaff, the Kashmir White Wagtail, and Accentors for the Brown Willow Warbler, Hodgson's Pied Wagtail and Hedge Sparrows respectively ; although *Accentor* has had to give place to *Prunella* as the scientific generic name these birds have long been popularly referred to both in England and abroad as Accentors and to discard this name now and to adopt as the trivial name that of the Hedge Sparrow seems to me both unnecessary and unsuitable. The *Prunellidae* are not Sparrows, nor related to Sparrows, and hedges do not exist in India nor would they be likely to be patronized by our Indian Accentors if they did. However I have strayed from my point which is that we are not—or should not be, at liberty to modify even trivial names.

Of far greater importance are changes in the scientific names, and here again we shall find in Mr. Whistler's article that no less than 25 generic as well as 17 specific or subspecific names are different from those in the List. To the experienced ornithologist such differences will merely cause annoyance. To the unskilled seeker after bird-lore they are apt to result in discouragement.

B. B. OSMASTON, M. B. O. U.

[We hope that in future Indian Ornithologists will endeavour, as far as is in their power, to adopt the nomenclature prescribed in Mr. Stuart Baker's Hand List so that this may be maintained as the standard until such time as the Volumes on Birds in the Fauna of British India series are complete. Bound copies of the Hand List are now available. Certain discrepancies in the nomenclature in the first Volume of the Fauna as compared with the names used in the Hand List have given rise to comment, but it is evident that Mr. Stuart Baker's labours in this connection and further research into this subject must necessitate the revision of certain names adopted in the Hand List, but for all practical purposes the Hand List must continue for the present to be our mainstay.

Mr. Stuart Baker writes to us:—

The avifauna when completed will *not* agree with my 'List'. The latter is merely a catalogue showing fairly well what had been done up to the date of the issue of the instalments and I am now working about 6 hours a day and alterations and additions will be constant throughout. The full work will, however, take about 5 or 6 years and I wanted men to know what had been done and what remained to be done. To correct commas, misprints, numbers, etc., would mean re-writing the whole work which is impossible. Corrections will only bring it *up to date* for *now.*

Replying direct to a another correspondent, Mr. Stuart Baker writes:—

"You say my new edition of the Avifauna should agree with the Hand-list. This latter was started and half-written before the Government of India asked me to undertake the new edition of the Avifauna, or perhaps, I should not have started it. The rewriting of the Avifauna will take some five years more—Vol. II is well advanced—and all this time it means I shall be working to get it really up to date. The Hand-list merely showed you what had been done up to the time the instalments had been written, and every week and every month has produced fresh knowledge since then. I expect you hardly appreciate the work such a volume as those of the Avifauna means. I am now starting on the genus *Cyornis* and I shall be proud if I can master its mysteries in two months!! That is one genus only among hundreds. I have to work up vast files of literature, get specimens and types from other museums, consult other naturalists on the Continent, Malaya, etc., and all this takes great time.

All the same I hope that for some time to come the Hand-list will be very useful. Scientific men who know all its faults and weakness are all asking for it. Men can see what has been done to date, and I hope many will write and let me know if they find inaccuracies in facts, not in commas and numerals, etc., which are of course due to local misprints. In fact many of these were put right by me in the proofs and again corrected by the local reader of the printer who thought he knew better than me.

Please read my preface to the catalogue."

As to the mistakes we confess with sorrow that Mr. Stuart Baker puts the matter very fairly except that we are certain the reader who made the corrections did not pretend to know better but erred through ignorance.—EDS.]

No. X.—NIDIFICATION OF THE HIMALAYAN TREE-CREEPER (*CERTHIA HIMALAYANA.*)

In Vol. XX, No. 2, pages 463-467 of the journal will be found a most interesting note by the late Mr. P. T. L. Dodsworth on the Himalayan Tree-Creeper (*Certhia himalayana*). As regards the nidification of this species Mr. Dodsworth stated: "The nests were invariably situated on trees, and were placed sometimes in holes belonging to other birds, but usually in chinks and crevices formed by thick branches shooting upwards from the main trunks.......The eggs were not laid on the bare wood, but the crevices or holes were lined with thick masses of small feathers, in which a few pieces of dry grass and straw were occasionally intermingled. In some cases the nests were mere pads of feathers on which the eggs reposed ; in others, the pads were more substantial, and the egg-cavities somewhat deeper. The nests were shapeless—exactly like those of the ordinary sparrow—and could not stand removal."

On the 14th April (Good Friday) 1921 I found a nest of this tree-creeper, about which nest, and with reference to Mr. Dodsworth's notes, the following remarks may not be out of place. The situation and structure of this nest differs somewhat from the descriptions given by Mr. Dodsworth, although it must not be forgotten that that gentleman wrote on the nidification of the Himalayan Tree-Creeper *in general.* I merely wish to record one of my own experiences, and by so doing, perhaps add a little information to Mr. Dodsworth's excellent paper.

I entered the following remarks in my note-book at the time :

"14*th April* (*Good Friday*). . . . I saw a hole in a large deodar (*Cedrus deodara*) on the left of the slope, and just outside the wooden railing of the road leading up to the Imperial Secretariat building by the back entrance. I should not have looked at it a second time, but a few stray twigs and a small piece of dirty rag were clearly visible. This excited my curiosity, for twigs and rags don't appear in holes of their own accord. I gave the collection a slight poke with my cane, and a female *Certhia himalayana* dashed out of the entrance-hole, which was situated about two feet higher up the trunk of the tree, and flew on to another deodar on the opposite side of the road. I made an attempt to extract the nest and its contents. From the lower hole a great quantity of loose deodar twigs was extracted, but no sign of a nest proper could be felt. By inserting my arm upwards into the passage I felt a pad about 18″ up. It was just out of reach, and I could not get a firm enough hold to pull it downwards. I then determined to try from above, but this I found was impossible, as the trunk had a narrow slit in it which communicated with the hole, but this slit would not admit my hand, even sideways ! . . . . Further twigs and some rags were pulled out from underneath, and still more and more, but no nest ! Again I felt it high up, firmly fixed in the hole. In such cases an axe is very useful. I procured one from the *malee* and set to work. I had the lower hole enlarged a little, and then I tried again. More sticks and. rags appeared, and eventually I got a firm hold on the soft nest and proceeded to drag it down. Very carefully I pulled it out and at last it came in view. With great care I got it clear of the hole and found that I had secured, undamaged, the entire clutch of five beautiful eggs. The following are descriptions of the nest and eggs :

Nest.—The site has already been described. The noteworthy feature was the under structure on which the real nest was placed. This consisted of a great quantity of twigs, principally deodar (*C. deodara*), most of them about half as thick as an ordinary lead pencil and about the same length, together with smaller twigs, several pieces of rag and some cotton. The amount of this material can be gauged when it is borne in mind that the hole was stuffed with it for about 18″. On the top of this strange mass of twigs, rags and cotton was superimposed the real nest. This again consisted : *first,* of a layer of exceedingly filthy rags (which I know are pickings from the office sweepers' godowns close by) about 1″ thick ; *second,* a cup made of cotton, string and crotchet thread ; *third,* a cup of fibres and hair of kinds ; and *fourth,* an inmost receptacle made entirely of a collection of light feathers one of which certainly belonged at one time to a domestic fowl. There was no lining (?)—the feathers served this purpose, for they were exceedingly soft to the feel. The nest measured about 1½″ in diameter and the same in depth. It was about 1″ thick in most parts, but where it rested against the hollow in the tree, it had a thickness which could not be measured ! Of course, the lower opening to the passage which contained the nest was neither an entrance nor an exit used by the bird.

Eggs.—Clutch of five. Ground-colour white, profusely marked all over with small reddish-brown freckles, the markings being minute near the thin end of each egg, and bigger, and forming an indistinct zone round the thick end. Both ends of each egg, however, are freckled clearly. The eggs appear to be suffused with pink. Eggs unfortunately a bit hard-set.

The nest described above was in a rift in the main trunk of a tree. It was also what I should call fairly compact, and it had quite a definite shape. It was removed successfully without breakage. Quite a fair amount of material, from twigs to soft feathers, was utilised in the construction of the nest. As already stated, I think the most noticeable feature of this nest was the foundation of twigs. These twigs could not have been in the rift of the tree-trunk before the bird began nesting, as some twigs were rather firmly wedged in, and, even if the twigs had fallen in to the hole, it is improbable that so many, and of a uniform size and thickness, could have collected therein.

SIMLA, S. BASIL-EDWARDES.
8th January, 1923.

No. XI.—THE OCCURRENCE OF THE WHITE-HEADED BLACK BULBUL (*HYPSIPETES LEUCOCEPHALUS*) WITHIN INDIAN LIMITS.

Two very interesting bulbul skins were recently forwarded to the Society by Mr. W. O. Hannyington from Taungyi, S. Shan States, Burma.

The first specimen, a grey bulbul with a white head, has been identified as Bingham's. Bulbul, *Cerasosphila thompsoni.* In connection with this species Mr. Hannyington writes :—

" The grey bird I saw here for the first time four years ago and have seen it frequently since. During the past year I have been observing it carefully and feel pretty sure it is a resident and it is strange that such a careful observer as Mr. Thompson did not notice it here in Taungyi."

The second specimen sent by Mr. Hannyington is still more interesting as its discovery in Taungyi makes an addition to the list of Indian birds. This specimen was forwarded on our behalf by Mr. Whistler to Mr. H. C. Robinson of the Federated Malay States Museum for identification. Mr. Robinson has since reported that he has identified the specimen as "*Hypsipetes* (*Microsceles*) *leucocephalus,* The White-headed Black Bulbul (Cat. Birds Brit. Mus., Vol. VI, 41).

This species is new to the Indian list having been previously recorded from China. Mr. Hannyington's remarks in connection with this species are as follows :—

" The black bulbul I saw for the first time at the beginning of December. There are still quite a number of them here (I saw some this morning, 1st January).

The above bird appears to associate with what I take to be the Burmese Black Bulbul (*Hypsipetes concolor*)."

BOMBAY NATURAL HISTORY SOCIETY, S. H. PRATER, C.M.Z.S.
30th May 1923.

No. XII.—NOTE ON A SUPPOSED NEW RACE OF *OTOCORYS ALPINUS*, THE HORNED LARK.

I have recently obtained a copy of the beautiful memoir published by M. Babault to record the results of his mission to India in 1914 to collect specimens on behalf of the Paris Museum. On p. 203 of the "*Résulas Scientifiques*" he describes a supposed new race of the Horned Lark from Rukshu which is named *Otocorys wellsi.* This new race is based on a male from Serchu and a female from Nima Mud, both obtained in July.

The new race is thus described :—

"Se rapproche beaucoup de L'*O. longirostris* de Gould, mais s'en distingue par la bande noire qu'elle a sur le devant de la tête, á la base du bec, et, qui mesure environ 2 millimetres de large. Elle est separee par une bande blanche étroite des touffes de plumes noirâtres qui se trouvent au-dessus des yeux. Cette bande characteristique donne a l'oiseau un facies special, qui le distingue immediatement des especes voisines."

It will be observed that the new race is practically based on a single specimen as the females do not shew the frontal markings clearly.

Now the type locality for *O. longirostris* is Kulu and I have a good series of these larks from Lahul and from the Rhotang range which lies between Lahul and Kulu and forms the Kulu locality for this bird. An examination of the males in the series shews that the character relied on by M. Babault for his *Otocorys wellsi* is a mere individual variation : in my series I find gradations from a pure white frontal band extending to the end of the nasal plumes at the base of the beak, to a black frontal band 2 mm. wide formed by the whole of the nasal plumes being black, and so dividing the white of the frontal band from the beak.

Otocorys wellsi of Babault therefore becomes a synonym of *Otocorys alpestris longirostris* of Gould.

DHARMSALA.
23*rd March* 1923.

HUGH WHISTLER, F. Z. S.,
Indian Police.

No. XIII.—THE SHIKRA. (*ASTUR BADIUS*).

I have read Col. E. O' Brien's note on the food of the shikra in the last issue of the Journal with interest. Early in my service I used to keep shikras for hawking purposes, and often flew them at birds other than their accustomed quarry (Mynahs and Quails) in order to learn the different tactics adopted by the different kind of birds when pursued by a hawk.

In these circumstances the majority of small birds dive into the nearest bush, into which the hawk hesitates to follow, for fear of injuring her wings, or if she does follow, the small bird, if it escapes the first rush of the hawk, can easily dodge her in the bush, or effect its escape from the bush more quickly than the hawk when it will rarely be followed.

The Common Babbler or Seven Sisters (*Crateropus canorus*) is a gregarious bird of feeble flight and I often wondered how they managed to survive the attacks of hawks. Being so slow on the wing they should, one would have thought easily fall a victim to the slowest and most unenterprising of hawks. On one occasion I noticed one of these babblers flying across an open space and I immediately decided to try my shikra at him. I launched the latter in the direction of the babbler and she took up the chase and caught the babbler easily before it had time to reach cover.

The babbler having been brought to the ground in the claws of the hawk began to scream lustily, and, in less time than it takes to describe, the rest of his companions came to his assistance and fell on the hawk without the least hesitation, attacking her vigorously with beak and claws.

I ran to rescue the hawk as I feared she would be injured physically as well as morally, if abandoned to the tender mercies of the Seven Sisters.

On my approach all the Babblers retired from the fray except two, one in the grip of the hawk and the other one of the hawk's assailants, possibly the mate of the bird which had been seized. I actually had to remove this bird which had gripped the hawk firmly with both feet ! It was clear from this experiment that it is mutual co-operation among the Seven Sisters which renders them more or less immune from the attacks of hawks.

On another occasion I was out with my shikra when I noticed a Kingfisher (*Alcedo ispida*) about 5 yards away seated on a dead branch, contemplating a slow flowing stream below.

I threw the hawk at the Kingfisher and the latter darted off up stream at its best pace. The Shikra followed and was steadily overhauling the former and in fact was about to seize it when the Kingfisher made a sudden plunge into the water. The disappearance of the Kingfisher was so sudden and unexpected that the hawk over-flew the spot and the Kingfisher emerging the next moment from the water, sped back down stream and got such a good start that the hawk gave up the pursuit. It struck me as particularly interesting that a bird should seek to avoid capture by diving into water, an act one would have thought only associated in its mind with the capture of fish !

GULMARG, KASHMIR,
29th August 1922.

B. B. OSMASTON, I.F.S.

No. XIV.—THE NIDIFICATION OF THE MALABAR GREAT BLACK WOODPECKER (*THRIPONAX HODGSONI*).

As I do not believe that the finding of the eggs of this fine woodpecker has hitherto been recorded the following may prove of some slight interest:—

The nest hole is excavated in a dead tree trunk, between thirty and fifty feet from the ground. The entrance is large and conspicuous being about 6 inches in diameter, and the hole extends down to a depth of about two feet. During excavation the ground for some yards around the base of the tree becomes littered with fragments of wood. The birds are extremely shy and impatient of observation. If they think that an undue interest is being taken in their movements, they will promptly desert their nesting site, their eggs, and even their young.

They lay two glossy white eggs, measuring about 1·40″—1·05″ towards the end of January.

Nelliampathy Hills,
21st February 1923.

A. P. KINLOCH, F.Z.S., M.B.O.U.

No. XV.—NOTE ON THE BREEDING SEASON OF THE PAINTED STORK (*PSEUDOTANTALUS LEUCOCEPHALUS*).

As the Fauna of British India, Vol. IV, says the Painte dStork (*P. leucocephalus*) breeds in N. India in September and October, it may be of interest to record that I took a fresh egg of this species on one of the big lakes in the Bhawalpur State on X'mas Day, 1922.

A number of these picturesque birds were sitting about on the Tamarisk trees round the jhil and there were nests in places. I did not expect that there would be any eggs in December, but I thought it worth while to enquire of the boatmen, who exploit the water birds, *e.g.*, the White Egrets, pretty thoroughly, in search of a living. To my surprise they said there was one nest with an egg in it, and sure enough there was. I expected to find it addled, but again to my surprise, it was quite fresh.

The Painted Stork is a sociable creature. At least six or seven were sitting on the tree on which was the nest (one of two) in which the egg was. There was no bird actually sitting on the nest. One could not help fancying that the others were there to admire and to congratulate the fortunate parent on an interesting event occurring so long after the usual season.

R. C. BOLSTER, I.C.S.

No. XVI.—THE BURMESE BARRED—BACK PHEASANT (*PHASIANUS HUMIÆ BURMANNICUS*).

I have seen and shot this pheasant on the hills around Loimwe, S. Shan States, at about 4,500 to 5,600 feet elevation.

Found in jungles composed of largish trees and thick undergrowth. Appears to like wild raspberry bushes, tall grass and other rank vegetation. Sometimes found in thick scrub jungle with no large trees.

I have never seen it in the open.

Generally found in small parties of from 3 to 5, though single cock birds are met with. It is easily flushed with dogs and usually takes to trees on such occasions. If however the sportsman is near the dogs, and consequently seen as soon as it rises, it makes straight off generally down hill.

Single birds appear to fly down hill invariably : when a covey is flushed, however, they fly in every direction, some up hill.

The flight is low, keeping through the trees, I have never seen them rise clear above them.

They emit a low chuckling sound, not unlike the "Coo" of a pigeon. If this sound is heard before the birds are disturbed it is exceedingly hard to locate. I have heard them make this sound when perching in trees, after being put up by a dog.

I have noticed that towards the end of the rains, when they first appear here, they are found at the tops of the hills, whereas, later on, when the weather gets colder and drier, they prefer the lower slopes. I have found them exceedingly difficult to shoot owing to the thick nature of the jungle they inhabit.

In April all the grass in the jungles for many miles round about Loimwe is burnt by the local Hill Tribes, consequently all game has perforce to depart, and does not reappear till the end of the rains when the jungle has grown again. Hence I know nothing of their nidification or habits for about seven months in the year.

In the cold season many of these birds are trapped in nooses by a hill tribe known as Kaws or E-Kaws. Most of the specimens I am sending were procured in this way. Latterly several birds have been brought in alive, and up to date I have bought three cock birds and one hen which I am keeping in a roomy cage or hut. I hope they will get tame in course of time and possibly breed later on.

The food of the birds I have skinned consists chiefly of small chestnuts (which abound in these jungles), also a red berry (the seed of a small plant) and occasionally a small snail or two.

The Silver Pheasants found round about Loimwe are generally found at a lower altitude than the Burmese Barred-back pheasants, though they also are found higher up at the end of the rains than later in the shooting season.

These birds haunt the thickest jungles, and I do not think they are nearly so readily flushed as the Barred-back. When they rise they make a great commotion and usually clear the tops of the trees and sail down into the valley below. When seen thus in the early morning or evening with the sun on them they are the most magnificent sight.

They invariably fly down hill.

I believe they go about in parties of two to four or more but, owing to their reluctance to fly, seldom more than a single bird is flushed at a time. The remainder presumably scatter in all directions in the undergrowth. I fancy that without dogs the sportsman would seldom see one of these birds at all.

I once saw three of these birds put up by dogs at once. This is the only occasion I have seen more than one in the air at a time. These three birds took to trees at once. They were some distance below me, and the hill side was very steep, and the tall grass hid a veritable entanglement of fallen trees and rocks. On my attempting to approach within range they all three silently sailed away from the far side of the trees.

On another occasion the dogs flushed a single hen bird in thick bushes. I only caught a glimpse of it. We followed the direction it took and while searching under a tree it suddenly flew from the tree immediately above my head and presented an easy shot. This is the only bird of this species I have shot this year.

I have no record of their food at present.

I have never heard of one of these birds being trapped.

LOIMWE, SOUTHERN SHAN STATES, J. G. P. DRUMMOND, Captain.
28th December 1922.

[The Silver Pheasant referred to by Captain Drummond is the Ruby Mines Silver Pheasant (*Gennæus nycthemerus rufipes*) which is the race occurring in this locality.—EDS.]

No. XVII.—A CURIOUS INCIDENT WHILE DUCK SHOOTING.

On the 15th of April I was out duck shooting on Khinsi Tank 30 miles from Nagpur in the Central Provinces. During the course of the morning I followed up a small nullah leading from the tank and put up a number of teal. One wounded bird dropped about 100 yards away on the far bank of the nullah. While my coolie was going to fetch it I saw a kite swoop down and pick it up. The bird flew slowly under the weight of the teal very near to the ground and in a direction diagonally towards me. To my surprise I caught a glimpse of a jackal chasing it at full speed through the low scrub. As the bird came within about 80 yards of me I fired both barrels to make it drop the teal but it took no notice and, after flying another 10 yards, settled on a small mound on the nullah bank. I ran full speed towards it but before I had gone many yards I saw the kite rise slowly and, as I mounted a slight rise in the ground, I was just in time to see the jackal, teal in mouth, disappearing through the scrub.

RAJKOT, W. T. W. JONES,
3rd May 1923. 4/10th Baluch Regt.

No. XVIII.—NOTE ON THE APPEARANCE OF THE STIFF-TAILED DUCK (*OXYURA LEUCOCEPHALA*) IN THE MIANWALI DISTRICT.

The appearance of the Stiff-tailed Duck in the Mianwali District may be worth recording as from Stuart Baker's "Indian Ducks and their Allies" it appears to be somewhat of a rarity. On November 27th, 1922, three stiff-tailed ducks were shot by H.E. the Governor of the Punjab's party on the Nammal Lake.

They appeared to be two immature males and a female. Their behaviour was very similar to that described by Stuart Baker, *i.e.*, they were very slow in getting up and behaved almost more like coots than ducks. The Nammal lake is an artificial lake formed by a dam in a gorge in the Salt Range for irrigation purposes. It consists of a wide open expanse and a long narrow neck between the hills. It was in a small inlet at the foot of the hills that these ducks were obtained. The identification has been verified by Mr. Hugh Whistler and Mr. Wright of the Aitchison College to whom specimens were sent and I understand the latter gentleman has made a sketch of the birds sent to him.

MIANWALI, PUNJAB,
1st January 1923.

M. M. L. CURRIE, I.C.S.

No. XIX.—PLUMAGE OF ADULT MALLARD (*ANAS PLATYRHYNCHUS*) AND NOTES ON WOODCOCK AND WOODSNIPE IN THE NILGIRIS.

I have several adult Mallard drakes and one female in my aviary and the former are of course at present in non-breeding plumage. The drakes somewhat resemble the duck but are much more of a rufous-brown especially about the breast; the speculum in my birds is brighter in the males and the outer tail feathers are of a different colour from those of the duck; the colour of the bill in the drakes is dull green quite different from the orange-brown and black of the duck.

In Volume XX of this Journal, pp. 854-855, Mr. Hadfield is quoted with regard to the arrival of Woodcock on the Nilgiris as saying :—" Cock evidently arrive in the Nilgiris during the month of October and never has this month gone by without a bird being bagged". My friend Col. H. R. Baker commenting on this writes to me " Curious, I wonder what year he was talking about, in the present day cock don't seem to come here till the 1st week in November. I think Hadfield must have been referring...... before these hills were so populated as they are now and before so many of the swamps were drained to make way for potato cultivation." With regard to bags of cock made in the Nilgiris, Col. Baker kindly sent me his experiences. He wrote in 1921 " *Now* a single gun is lucky, as I have been, if he gets 30 to 40 cock in a season and 6 in a day. In 1920-21 I got 35 and in 1921-22 I got 29 and in both seasons my best bag was 6 in a day out of 7 seen."

His remarks on the Woodsnipe in those Hills are also most interesting and I take the liberty of quoting from a letter he sent me : " In 1920-21 I did not see a single Woodsnipe or Fantail, while this season I shot five Woodsnipe (in February and March) and *one* Fantail ! whereas my son shot early in November last on his estate in Mysore District and sent me the skin of a Woodsnipe which showed they, the Woodsnipe, arrive so early there and so late here, only a few hundred miles further south".

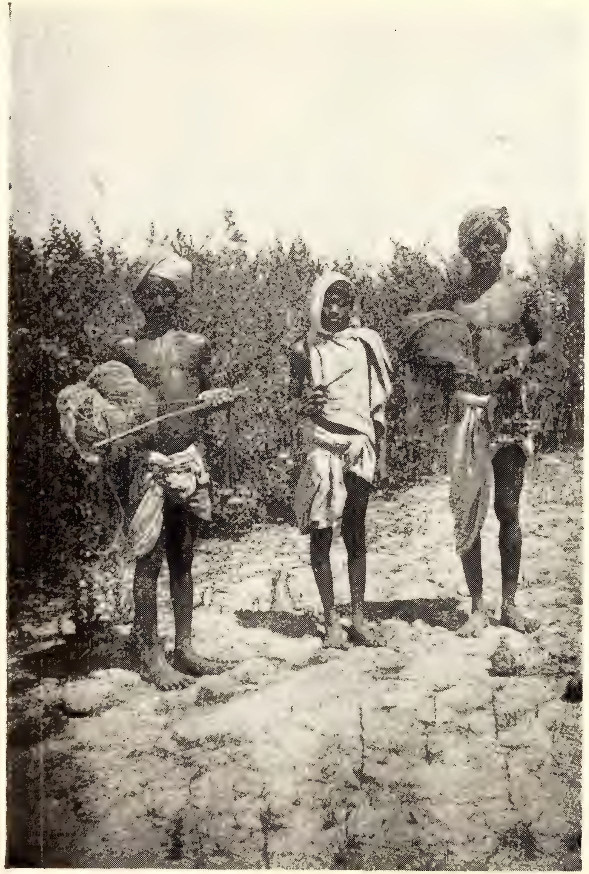
CHAS. M. INGLIS, F.Z.S., F.E.S., M.B.O.U.

BAGHOWNIE DARBHANGA,
6th August 1922.

No. XX.—ON THE BIRDS OF THE NELLIAMPATHY HILLS.

I have recently spent a fortnight on the Lily Downs in Cochin Nelliampathy and observed several species which do not occur elsewhere on these hills. The Downs consist of undulating short grass-land dotted with frequent patches of evergreen sholah and are about 3 miles long and 2 broad with a mean elevation of some 4,700 ft.

SNARING QUAIL IN NORTH BIHAR.



QUAIL SNARERS WITH NETS.

THE NETS *in situ.*

1. The Nilgiri Thrush (*Oreocincla nilgiriensis*) was numerous and its beautiful song was heard in every sholah. The sholahs of the Downs are terribly thick and the trees covered in moss, lichen, etc., which makes bird-watching peculiarly difficult but I was lucky enough to be able to observe this very handsome thrush and its habits on several occasions.

2. Bourdillon's Black-bird (*Merula bourdilloni*) replaces the common blackbird of the plateau country (The Black-capped black-bird, *M. nigripileus*) on the downs and is there common.

3. The Nilgiri House Swallow (*Hirundo javanica*)—Two species of Swallow were very common. The Nilgiri House Swallow (*Hirundo javanica*), which was constantly flying in and out of the wooden shooting box in which I was staying and which had several nests under the eaves of the hut, and

4. Hodgson's Striated Swallow (*H. nepalensis*) which did not frequent the neighbourhood of the hut and had a mode of flight quite different from *H. javanica* in comparison with which species it flew higher above the ground and with a slower and more distinctive motion.

5. The Indian Pipit (*Anthus rufulus*) on these downs replaces *A. maculatus*, the common Pipit of the lower plateau country.

6. The Common Indian Swift (*Cypselus affinis*) was fairly common and I mention it here as I do not think I have noticed it elsewhere in the district.

7. The Painted Bush-Quail (*Microperdix erythrorhynchus*)was in large numbers, round the edge of every sholah These pretty birds are absurdly tame and seem even more deficient in intelligence than most gallines. By sitting on a rock a few yards from a sholah edge, early in the morning or late in the evening, and keeping still I could have repeatedly knocked these birds over with a stick. They came within a couple of feet of my boots on one occasion.

NELLIAMPATHY HILLS, A. P. KINLOCH, F.Z.S., M.B.O.U.
15th April 1923.

[Previous notes on the birds of the Nelliampathy Hills appeared in Vol. XXVII, p. 939, Vol. XXVIII, p. 279 and Vol. XXIX, p. 294.—EDS.]

No. XXI.—FURTHER NOTES ON SNARING QUAIL IN NORTH BEHAR.

(*With a plate.*)

In Vol. XXVII, No. 4, pp. 947-48, I wrote a note on snaring quail in this district in paddy stubble, khesari and gram. This year I had a further opportunity of studying the snarers' methods in tall crops such as *rahar* (*Cajanus indicus*) to which the quail retire during the heat of the day.

No preparation is required in the way of dress in snaring by the following method, but more people are generally necessary, the number varying from three to eight. On arriving at the spot where the *rahar* fields are situated, the men, if the fields are not of any large extent, skirt round them, crouching and looking into them to see if they hold any birds ; they then fix a site for their nets, selecting a spot in which the crop is thin or absent. The nets used are the ordinary fishing ones. They are stretched out, the ends being tied to the crop or any jungle that may be handy, and the portion resting on the ground is weighted down with clods, except in those nets, such as casting nets, which are already weighted. On the flanks of these nets, the smaller nets (as described in my previous article) are fixed, the whole extending for about 11 yards. Any crop that may come under the net is bent down and the net passed over it and this keeps the nets in a raised position.

The driving now begins. If there are several fields of *rahar* adjoining each other, the snarers usually try to drive the quail into one plot. The driving is done by wriggling along in a squatting position, every now and then gently shaking the crop and the whole time keeping up a low whistle. The quail either run or walk along in front of the beaters and are headed towards the nets and finally captured. Sometimes a dozen or twenty birds are snared at one time and sometimes a blank is drawn. I have been with the men several hours when nothing was caught, this being generally due to the quail having been disturbed by grazing cattle and made very wild. Sometimes other birds besides quail are captured and on one occasion these consisted of a pipit and a water hen ; a mongoose also got into the net but got away. I once chased away a fox, fearing the damage it would do to the nets if it got entangled in them.

This season was an exceptionally good one for quail, hundreds being snared. Of the large number I saw, all, except about a dozen Little Button Quail (*Turnix dussumieri*) and one Black-breasted Quail (*Coturnix coromandelica*), were the common species *Coturnix coturnix coturnix.*

I have never been able to discover the line of migration taken by the quail which visit us. Hume says : " Into India quails migrate from the north, from Central Asia across the Himalayas, and from the west, from Persia, Baluchistan, &c., besides those in Sind, Kathiawar and Northern Guzerat a few make their appearance, occasionally if not regularly, having crossed by sea from Arabia and Africa." They probably cross the Himalaya somewhere in Nepal. According to Hume good and bad quail years are due to the deficiency or otherwise of the crops ; when deficient in the north, numbers passing over to the south and when sufficient in the north comparatively few travel to the south. This does not seem to hold good. Last year the crops in this district were rather better than they were this year, yet last year was a very bad and this year was an exceptionally good quail year. Neither does the rainfall seem to account for the vagaries of quail migration as may be seen from the following table :—

Rainfall.		Quail Seasons.	
1916	59.90	1917	No quail.
1917	41.50	1918	Only a few.
1918	60.55	1919	Good year.
1919	44.35	1920	Only a few.
1920	48.25	1921	Very common.
1921	58.45	1922	Very bad year.
1922	58.25	1923	Exceptionally good year.

The rainfall of 1921 and 1922 were practically the same, yet the former was a very bad and the latter an exceptionally good year.

I hope some of our members will give us their views on the subject.

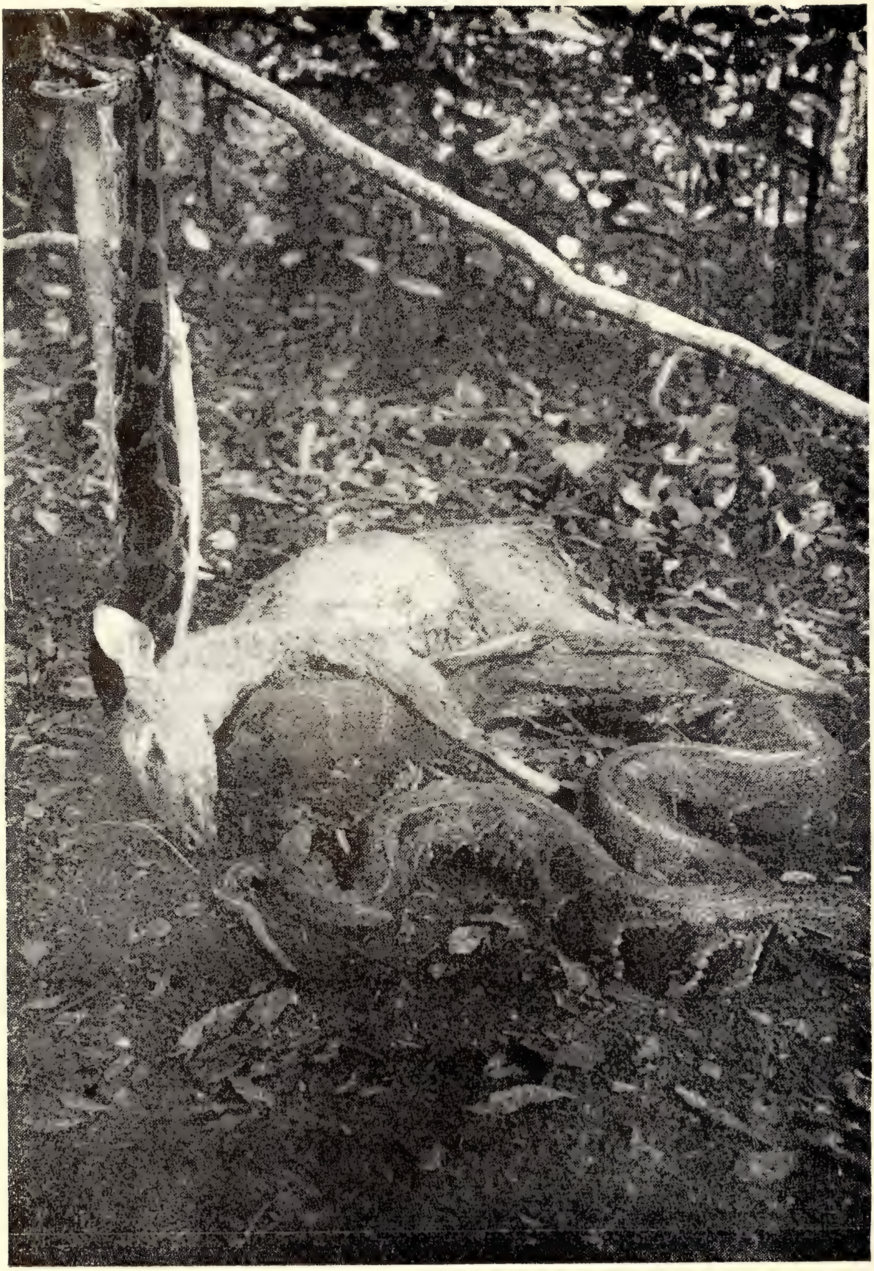
BAGHOWNIE, DARBHANGA,
28th May 1923.

CHAS. M. INGLIS, F.Z.S.,
F.E.S., M.B.O.U.

No. XXII.—A PYTHON'S MEAL.

(*With a plate.*)

It is well known that snakes do not masticate their food and are capable of swallowing animals the girth of which is much greater than their own. Seldom does the opportunity occur of capturing a large snake immediately after he has had a big meal and more rarely do circumstances permit of a photographic record being secured.



A 15-foot Python (*P. molurus*) with a full grown female Barking Deer removed from its stomach.

The plate shows a python 15 feet in length and a full-grown female barking deer which was removed from its stomach. The deer was covered with slime and had been swallowed only a few hours, for the only evidence of digestive action having commenced was in the eyeballs which are seen to be unnaturally white.

The manner in which the body was arranged for swallowing is interesting and must have been carried out intentionally by the snake. Swallowing commenced at the head but the hind legs were brought forward with the hooves together against the throat while the fore legs trailed backward against the belly and between the hind legs. Not a bone was broken and the only injury to the skin was the wound plainly seen on the near fore leg where the deer had been seized by the snake. The python was reported by Burmans to be in dense undergrowth in a swamp and it was decided, in order to get the skin undamaged, to take it alive. The capture was effected with the stick shown in the picture to the forked end of which a rope noose was attached. The noose was passed over the snake's head (an operation simpler than it may appear) and then drawn tight; the reptile was soon helpless. The photograph was taken as soon as writhing subsided. That the python was still alive is proved by the breathing aperture within the mouth being distended.

The capture was made and the photo taken by myself on 12th June, 1922, near Baw, about 15 miles southward from Maymyo.

MAYMYO, J. MORROW CAMPBELL, D.Sc.
19*th August* 1922.

No. XXIII.—AN UNUSUAL SWARM OF MOTHS.

On page 814 of Volume XXVIII, part No. 3, Mr. T. R. Bell remarks that he does not know the local food plant of *Agrates flammatra*, Schiff. With regard to this, in Volume I of the Proceedings of the third Entomological meeting held at Pusa in 1919 on p. 63 there is the following :—" Occurs throughout Northern India, Pusa being apparently its most southern limit as far as records go. As a pest it is very minor and sporadic in most localities but it is stated to be a very serious pest of almost all low-growing plants (tobacco, gram, &c.) in the spring at Lyallpur and throughout the Punjab. The Pusa collection contains examples reared from larvæ on gram and tobacco at Pusa, on gram and *piazi* (*Asphodelos fistulosus*) at Lyallpur and on poppy at Gonda (Oudh) in March 1890."

This moth is quite common here, but I have never found such large numbers as mentioned by Lt.-Col. J. Patterson.

BAGHOWNIE, LAHERIA SARAI, N. BEHAR, CHAS. M. INGLIS, F.Z.S.,
5*th August* 1922. F.E.S., M.B.O.U.

No. XXIV.—NOISES MADE BY ANTS.

Professor J. Arthur Thomson in his fascinating book " The Wonder of Life" refers to the alarm signals made by various termites, a crackling or hissing noise produced by banging their heads against the galleries of the termitary.

Some of the true ants, for instance the savage pale-orange " red tree-ant " *Æcophylla smaragdina,* and the equally vicious little dark red " cock-tail " tree ant, *Cremastogaster* sp., produce a loud hissing or rustling sound when their nests are disturbed, and this might be caused in the same manner as the sounds the termites give forth when alarmed, but how do the large, shiny, carnivorus black ants, *Camponotus compressus,* make the loud hissing noise they do when disturbed *on the march* and with nothing more substantial to knock their heads against than thin air?

Nelliampathy Hills, A. P. KINLOCH, F.Z.S., M.B.O.U.
9th February 1923.

[In his article " Our Ants " in Vol. VII, p. 27, of the Society's Journal, Mr. Wroughton comments on the sound producing qualities of ants. He says :—

" I can only refer any member interested in the matter to Sir J. Lubbock's " The Senses of Animals " as containing the most easily available summary of the question. There is one point in that work, however on which I am able to offer an ' experience'. Lubbock records that a *Mutilla* (a genus closely allied to the ants) " makes, when alarmed, a rather sharp noise by rubbing one of the abdominal rings against the other." A similar organ has been found in the ants of the genus *Ponera,* " which, in the structure of its abdomen, nearly resembles *Mutilla* " and finally, in the " true ants " has been found " a similar rasp-like organ in the same situation". He adds, however, " that ants produce no sounds which are audible to us. ' I am almost certain, however, that I have heard such sounds. When one of the large ' brown paper ' nests of *Cremastogaster rogenhoferi* is violently, and suddenly, disturbed, the ants swarm out in thousands, ' wagging ' their abdomens, in the manner so characteristic of *Cremastogaster* when excited ; at such times a distinct hissing sound is audible, as if a red hot-cinder had been plunged into water. I had always accounted for this by supposing it was caused by the material of the nest under the feet of the ants, and a similar, though fainter, sound, which may be heard when a large nest of *Camponotus* or *Polyrachis spinigera,* is disturbed, by the rubbing together of the bodies of the ants, who are all in violent movement at once. The passage from Lubbock quoted above, however, leads me to think that this is not so, but that the audible noise is the sum of the individual stridulations of countless ants. The ' tail wagging ' of *Cremastogaster* would account for the sound made by them being louder, though they are so much smaller than *Camponotus* or *Polyrachis.* I had asked Mr. Aitken to make some experiments to check the results I thought I had obtained. Members will no doubt recognise his hand in the following characteristic note which fully supports my contention. " I do not need to experiment. The roar raised by a squadron of *Lobopelta,* if you poke at them with a straw, does not require to be listened for with your hand to your ear. I should like, however, to know something about the ' organs ' by which it is produced. Military drums ! I should think."—Eds.]

A VOCABULARY.

1.	A number of partridges together	" Covey "
2.	Large number of grouse together at the end of the season.	" Pack "
3.	A number of pigs together	" Sounder "
4.	A number of duck in the air	" Flight "
5.	A number of duck on the open water	" Paddling "
6.	A number of duck on their feeding grounds	" Company "
7.	A number of snipe in the air	" Whisp "
8.	A number of geese in the air	" Skein "
9.	A number of geese on their feeding grounds ..	" Gaggle "
10.	More than one mungoose	" Mungooses "
11.	Two hen pheasants and a cock as a gun's share of the bag.	" A Leash "
12.	Two cock pheasants and a hen as a host's present ..	" A Faux Pas. It's not Done"

From the Gymkhana Review—March 1923.

NOTICE TO ENTOMOLOGISTS.

The attention of Entomologists throughout the world is called to the fact that, beginning with the volume for 1922, the preparation of the "Insecta" part of the "Zoological Record" is being undertaken by the Imperial Bureau of Entomology. In order that the Record may be as complete as it is possible to make it, all authors of entomological papers, especially of systematic ones, are requested to send separata of their papers to the Bureau. These are particularly desired in cases where the original journal is one that is not primarily devoted to entomology. All separata should be addressed to :

The Assistant Director,
Imperial Bureau of Entomology,
41, Queen's Gate, London,
S. W. 7, England.

PROCEEDINGS

ANNUAL MEETING HELD ON THE 26TH APRIL 1923 AT THE PRINCE OF WALES' MUSEUM.

Mr. R. D. Bell, I.C.S., C.I.E., *Presiding.*

ELECTION OF NEW MEMBERS.

The election of the following 28 members since the last meeting was announced:—Mr. J. R. Farquharson, Bombay; Mr. S. R. Turnbull, Madras; Mr. Jamshedji Kawasji Dubash, Bombay; Mr. J. G. Ryan, Cawnpore; Mr. R. R. Kirby, Kurseong; Major Rodney Foster, I. A., Multan; Mr. G. V. R. Frend, Kadur; Lieut. K. C. Warrand, Meerut; Mr. L. D. de la Nougerede, Nowgong; Mr. A. N. Fitz Gerald-Moore, Bombay; Major O. G. Kiernander, Iraq, Mesopotamia; Mr. A. Chrystall, Salona, Assam; Mr. F. H. Munro, Misa, Assam; Capt. Alexander R. Palmer, R. N., Bombay; Mr. E. T. C. Farr, Koni, Punalur; Mr. H. Campbell, Bar.-at-Law, Bombay; Mr. A. S. Vernay, Attikan, P. O.; The Honorary Secretary, McMahon Museum, Quetta; Mr. J. T. O. Barnard, C.I.E., Fort Hertz, Putao; Capt. C. J. S. Fraser, Fort Hertz, Putao; Mr. R. D. Rowlands, Bombay; Mr. E. Hauser, Bombay; Mr. N. T. Porter, I.C.S., Seoni Chhappara, C. P.; His Excellency the Earl of Lytton, Governor of Bengal, Darjeeling; Mr. Framroze Ardaseer Daver, Bombay; Mr. H. F. Knight, I.C.S., Bombay; Major F. O. Bowen, Bombay; Major J. St. Aubin-King, Poona.

ACCOUNTS FOR 1923.

The Honorary Treasurer presented the audited accounts for the past year for the approval of the members, and in a brief explanation stated:—" Leaving out of consideration for the moment receipts and expenditure on account of the Mammal Survey and Prince of Wales' Museum, we find our receipts for 1922 were about Rs. 8,600 less than for 1921. This is almost entirely accounted for by the difference in life-membership subscriptions. On the raising of the amount of the life members' subscription in 1921, we received Rs. 11,609-8-0 whereas this year at the higher rate we have only received Rs. 2,923-8-0, a difference of about Rs. 8,600. We lost last year our Government grant of Rs.15,000, but we gained in sales of journals, game books, interest on investments, etc., about Rs. 15,800. Current subscriptions have remained almost unaltered.

" Our expenditure was some Rs. 15,562 less than in 1921. This is made up by a drop in salaries of Rs. 13,046-10-11, owing to the Prince of Wales' Museum now paying 50 per cent. of the salaries of certain of those employed by the Society, and by one or two smaller items of expenditure.

" The position is, however, not a very satisfactory one, as our income from sales of books, charts, etc., is not a permanent income and should be earmarked for paying off printing and other charges which are still outstanding.

" At the close of the year 1922, the number of members on the books were:—Life members 157 and ordinary members 1,280. During 1922, 144 members resigned, 79 members joined and two rejoined."

PRINCE OF WALES' MUSEUM.

" Except so far as the staff is concerned the financial position of the Natural History Section of the Museum does not appear to be in a good position. It has a grant from Government of Rs. 17,500 which, I understand, may be increased to Rs. 19,000, and last year received interest from investments, etc., amounting to Rs. 1,000. Expenditure on standing charges will consist of salaries Rs. 15,500 and sundries Rs. 1,000 which should give it a balance of about Rs. 2,500 a year for maintenance expenses. But as regards provision for exhibits, we have at present housed only the mammals at a cost of Rs. 22,000 and it is estimated that as much again will be required to complete the bird and reptile galleries, whereas the available cash resources at present are under Rs. 10,000. Unless very considerable financial help is speedily forthcoming there is little hope of being able to give the public of India the full benefit of the magnificent collections the Society can place in the Museum.

MAMMAL FUND.

"On 31st December 1922 the Mammal Fund had a balance of Rs. 21,700. During the past year we received Rs. 5,600 in donations and the second half of the Government of India Grant, viz., Rs. 22,500. The Government Grant has now ceased and unless we receive donations no further income can be looked for this account. Salaries, however, will be considerably less this year as we only have Mr. Wells and Mr. Baptista working for us. It is unlikely that fresh funds will be forthcoming and we must rely in future on work done for us—as has been done in the past, by honorary workers. The need for the Mammal Survey still exists—especially in the Eastern Ghats and parts of Burma, but looking back on what has been effected we may well be proud of what the Society's Mammal Collectors have accomplished."

The Honorary Secretary, Mr. R. A. Spence, stated : "The position as the Honorary Treasurer says is not over satisfactory. The payments for life membership should go to capital and not be treated as revenue and, as the Honorary Treasurer points out, the amount received on account of sale of the game books has to be remitted to the printers. "144 members resigned against 81 who joined ! ! " A few more years like last year will write "finis" to the history of this Society. Yet all that is needed is for the members themselves to help the Society by getting new members so that future reports will read : "150 new members joined and only 50—owing to unavoidable causes —resigned."

THE PAST YEAR.

The Honorary Secretary stated that the next business was to elect a Committee for the coming year, but before doing so he was sure the members would like to express their appreciation of the work done by the out-going committee. The past year had marked many changes in the history of the Society. The Society was now under Royal Patronage—H.R.H. the Prince of Wales having become Patron of the Society, and it was hoped that before long there would be a noble list of Vice-Patrons who had shown their solid appreciation of the work of the Society and their desire to help on the work it was doing by contributing Rs. 5,000 each. The money so subscribed would be spent by the Society for the benefit of the citizens of Bombay in improving—or perhaps we might with greater truth say creating—the Natural History Section of the Prince of Wales' Museum to which section in the year under review all the Society's collections suitable for exhibit to the public had been removed. He then referred to the great loss the Society had suffered through the death of Mr. P. J. Mead, C.S.I., C.I.E., I.C.S., who had been a member of the Committee for many years and whose advice had always been of great assistance to the Society. On behalf not merely of the Committee but of the whole Society Sir Norman Macleod, Chairman of the Committee, had written expressing their sincere sympathy with Mrs. Mead and stating in brief and simple terms their appreciation of Mr. Mead's life and work.

A hearty vote of thanks was passed to Mr. T. A. M. Hill, the Honorary Treasurer, for his services as also to his predecessor Mr. H. F. Lodge.

OFFICERS OF THE SOCIETY.

PATRON.

H. R. H. The Prince of Wales, K.G.

The following gentlemen were elected as Office Bearers for the present year:—

PRESIDENT.

His Excellency Sir George Lloyd, D.S.O., G.C.I.E.

VICE-PRESIDENTS.

Mr. J. D. Inverarity, B.A., LL.B.
The Hon'ble Sir Norman Macleod, Kt.
H. H. The Maharao of Cutch, G.C.S.I., G.C.I.E.

HONORARY TREASURER.

Mr. T. A. M. Hill.

HONORARY SECRETARY.

Mr. R. A. Spence, M.L.A., F.Z.S.

MANAGING COMMITTEE.

Mr. T. Bainbrigge-Fletcher, F.E.S.; Mr. T. R. Bell, C.I.E., I.F.S. (Retd.); Mr. R. D. Bell, C.I.E., I.C.S.; Rev. E. Blatter, S.J.; Mr. J. P. Bradshaw; Lt.-Col. W. H. Evans, R.E.; Major F. C. Fraser, I.M.S.; Mr. J. E. B. Hotson, I.C.S., O.B.E.; Prof. V. N. Hate, M.A.; Mr. C. N. Inglis, F.Z.S., M.B.O.U.; Mr. H. F. Lodge, M. C.; Mr. F. Ludlow, I.E.S., M.B.O.U.; Sir Henry Macnaghten, KT., M.A., M.L.C.; Mr. J. G. Ridland; Mr. P. M. D. Sanderson; Major C. H. Stockley, D.S.O.; Dr. D. A. Turkhud; Major J. Taylor, D.S.O., I.M.S.; Mr. H. Whistler, F.Z.S., M.B.O.U., C.F.A.O.U.

The President and Vice-Presidents, the Honorary Secretary, and Honorary Treasurer being ex-officio members of the Committee.

SOCIETY'S REPRESENTATIVES IN ENGLAND.

W. S. Millard, Esq., F.Z.S.
E. C. Stuart-Baker, Esq., M.B.O.U., C.F.A.O.U., F.Z.S.

PAPER READ.

Prior to moving to the Natural History Section of the Museum to examine the mounted specimens which Mr. Prater, the Acting Curator, had mounted and arranged, a very interesting paper on his deputation to several of the Museums in England was read by him.

MONTHLY MEETING HELD ON 3RD JULY 1923.

MR. R. A. SPENCE, M.L.A., *Presiding.*

Owing to the inclemency of the weather in the morning the weather-wise officials of the Society decided that no one would be likely to attend the meeting. They therefore vetoed the provision of the usual light refreshments and, when correcting the report of the meeting (which had not yet taken place) for the press, stated that owing to paucity of attendance on account of the inclement weather the reading of the paper on the "Red Ants" (by Major Hingston) was postponed to a future occasion. The evening turned out fine however and the attendance of members was a record for many years past. Major Hingston's most interesting paper was greatly appreciated but as the reading of his paper took over 45 minutes the gentleman who read it regretted that the Society had provided nothing to moisten his throat.

It is pleasant to record the interest the local members are taking in these revived meetings. It is hoped to have them every month in future and the Honorary Secretary is trying to arrange for the Master of the Trawler, "Madras" to exhibit, at an early meeting, specimens of edible fish obtained by him and referred to in the report on the 'William Carrick' by Mr. Hefford. A discussion on this report, extracts from which are appearing in the journal, would take place at the same time. It is also hoped to arrange for an illustrated lantern lecture by Mr. J. Addyman, M. L. C., on the Honey Bee.

Mr. S. H. Prater, the acting Curator, gave a brief account of the progress made in the past month in the Museum, and the taxidermist's work done in the Society's room was much admired.

ELECTION OF MEMBERS.

The formal part of the meeting consisted in the election of the following 8 new members—Mr. M. A. Cartland, Ghazipur, U. P. ; Lt.-Col. F. L. Nicholson, D. S. O., M. C., Mount Abu ; Mr. F. W. Champion, I.F.S., Garhwal, U.P. ; Capt. H. C. Bridges, Trimulgherry, S. I. ; Mr. A. Johnson, Wellington ; Mr. G. E. Banwell, Rangoon ; Mr. George Gothorp, Thakurbari, Assam; Mr. R. C. Ashfield, I.C.S., Saugor, C.P.

The Honorary Secretary intimated that he considered this very pleasing result was due to three things working together—the recent issue of the journal, the issue of a new application form for membership, and the keenness of members themselves, and he expressed the hope that this would continue. A new journal would be issued it was hoped at the end of July and this would be sent out, to save postage and packing expenses, along with the indexes for Volume XXVIII.

MONTHLY MEETING HELD ON 1ST AUGUST 1923.

MR. R. A. SPENCE *Presiding.*

A meeting of members and their friends was held in the Board Room at the Prince of Wales' Museum, Bombay, on Wednesday, the 1st August.

ELECTION OF MEMBERS.

The election of the following 10 members was announced by the Honorary Secretary :—Capt. J. R. M. Hanna, Putao, Burma ; Mr. J. H. Cantlay, Vandiperiyar P.O., S. India ; Mr. John Macdonald, Yatung, Tibet ; Mr. F. N. Chasen, Singapore ; Major J. A. H. Briton, Baroda ; Mr. B. G. Gillett, O.B.E., Bombay ; Mr. R. Knight, Bulsar ; Mrs. F. Heard, Lower Dharmsala, Punjab ; Major M. Goodall, Sadiya, Assam ; Mr. A. Simonds, Dimakusi, Assam.

RECORD BLACK BUCK'S HEAD.

The record Black Buck's head, measuring : right horn 30″, left horn 31⅞″ and between tips 28¾″ sent to the Society by H. H. the Maharaja of Jind to be mounted, was greatly admired. This is one of the first specimens mounted for members in the Society's work room under the direction of Mr. Prater, and Mr. Prater is to be congratulated not only on the excellent way in which he has done the work but also on his good fortune in being able to set up such a glorious trophy. The Honorary Secretary advised those present to send their trophies to the Society to be mounted but warned members that the work for the Museum must take preference and consequently the Society could not guarantee to do all the work sent to it. Application should be made before shikar trophies were sent in. Thanks to the kindness of the Maharaja of Jind, the Black Buck's head will be on view for the next month in the Natural History Section of the Prince of Wales' Museum.

FISH SUPPLY OF WESTERN COASTS.

The Honorary Secretary referred to the report on the work of the steam trawler " William Carrick " by Mr. Hefford, Marine Biologist to the Government of Bombay. Extracts and comments on this report will appear in the Society's Journal and the report has already attracted considerable notice in the Press and attention from those interested in the supply of fish to " Urbs prima in Indis." In the paper special stress is laid on the unsuitability of the " William Carrick " for the requirements of the Bombay fish market and the need for small motor boats equipped with Seine nets. This point was brought to the notice of those present by Capt. Mitchell of the steam trawler " Madras " who attended the meeting and gave the members the benefit of his personal experiences whilst engaged in trawling off the Bombay coasts.

First it must be emphasized that though the " Madras " was a trawler of the large type like her predecessor, the " William Carrick," she was employed solely in commercial trawling and not in scientific work, hence it is not surprising that, despite her being laid up for repairs for nearly five weeks from the end of May till the end of June, she landed 2,86,000 lbs. of fish in five months during which she made 40 voyages whilst the " William Carrick " in nine months made only 33 voyages and landed 1,80,000 lbs. of fish. Out of the total quantity of fish landed about 53,000 lbs. were skate and, in addition to the quantities landed, over 1,08,000 lbs. of skate were thrown overboard! Those will wonder why who have had acquaintance with the fried fish shops in England especially in the fishing towns, and know that when these shops have skate they announce it in their windows and that there is a big demand for it, the price at times reaching one shilling a pound. The answer lies in the conservatism of the people of Bombay. Had the fish realised but one anna a pound the quantities were so large that the trawling would have been a financial success. The skate was new to the public, so skate must not be eaten! It did not pay to land it and the fish was thrown overboard. Capt. Mitchell expressed his strong disapproval of this as not only did it seem like throwing good money into the sea and wasting valuable food stuff but harm was done to the fishing grounds through the discarded fish sinking to the bottom and putrifying, thereby driving away all other fish to some healthier locality. We wonder whether, had the skate been landed in Bombay and putrified on shore, the public, to abate the nuisance, would have consumed the next consignment and so become acquainted with its merits? Verily, we are a strange people. We complain of high prices. We object to the consumption of the flesh of animals in a tropical country, yet when Providence sends us a plentiful supply of good cheap food we turn up our noses and say ' Atchcha nahin.'

COLD STORAGE.

With regard to cold storage, Capt. Mitchell expressed his opinion that if one wanted really fresh fish, and not frozen fly-blown fish, small refrigerators should be erected at the points where the fish were landed. The fish could be conveyed at once from the boat to the refrigerator and from thence taken as required by closed motor vans either to the kitchens of large consumers or to cold storage receptacles at the various markets. Perhaps we ought not to give away the locality of the best fishing grounds, but if any are of the opinion that steam trawlers or motor boats will interfere with the vested rights of the sailing boat fisherman we would relieve their minds by assuring them that the "Madras" best fishing ground was at too great a distance from the land to be frequented by native fishing boats.

Mr. Hefford, Marine Biologist to the Government of Bombay, explains in his report, and illustrates his point in an excellent map, that to go too far to sea is to lose one's fishing ground, as beyond the 200 fathom line which runs, comparatively speaking, close to the shores of Bombay it is not possible to trawl along the bottom.

Capt. Mitchell told us how it does not follow that the farther one goes up or down the coast from Bombay the better the fishing becomes. In fact a voyage to that sister city famed for her oysters and fish, Karachi, would have proved a failure had it not been for a lucky stop off Diu Head, some 150 miles from Bombay, which proved a good fishing ground. 14,000 lbs. of fish were caught here in 36 hours and in the last haul the net burst with the tremendous weight of fish thereby losing about two-thirds of the catch.

An interesting discussion followed, and the members then turned their attention to the improvements made in the Natural History Section since the last meeting. Mr. Prater and his assistants are certainly to be congratulated on the work they are achieving here, work done locally and with very limited funds.

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Printed at the Times Press, Bombay, and published by R. A. Spence for the
Bombay Natural History Society, Bombay.

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